CHAPTER 3 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This Chapter describes the current environment within the Prehistoric Trackways National Monument (PTNM). Many, though not all, of the sections within this Chapter correlate with programs for which the Bureau of Land Management (BLM) intends to make management decisions through the planning process. These resources and uses may be affected by the implementation of any of the management alternatives, but the current environment gives a baseline to which to compare the impacts from the different alternatives.

3.2 RESOURCES AND USES

3.2.1 Paleontological Resources

Within the Monument, evidence of life that once existed along an ancient tidal flat is contained in red stained layers of sandstone, siltstone, and mudstone that are referred to as the Robledo Mountain Formation (some call this the Abo Formation). These red layers are interbedded with grayish-yellow limestone layers that were laid near shore and in deeper waters of a regressive-transgressive Permian-aged sea. Together, these rocks comprise what is known as the Hueco Group. The limestones of the Hueco Group contain a number of marine invertebrate fossils that include brachiopods, snails, and crinoids.

Figure 3-1 Amphibian Trace. Illustration by Matt Celeskey, NM Museum of Natural History & Science

Paleontological resources may also be found in sedimentary rocks that were deposited during the Oligocene Epoch through the Pleistocene Epoch. These sediments constitute the filling of the Rio Grande Rift and are collectively known as the Santa Fe Group. Fossils found in the Santa Fe Group are typified by terrestrial vertebrates.

In the sedimentary rocks, the movements of animals have been preserved in the sands, silts, and mud of the tidal flat for almost 300 million years. Jumping trails of wingless insects have been preserved. Activities of amphibians (see Figure 3-1), reptiles, a variety of arthropods including horse shoe crabs (see Figure 3-2), and insects are recorded in the red beds. Even impressions of the animals themselves have been documented by recent discoveries of sea anemones and jelly fish.

These impressions in rock are called trace fossils (*ichnofossils*) and they can be used to develop a picture of what life was like on the coast of an inland Permian sea 280 million years ago (see Figures 3-2 and 3-3), before the age of dinosaurs. Leaf impressions and petrified wood (see Figures 3-4, 3-5, and 3-6,) tell what was growing on the landscape. When the sea level rose, the tidal flats were inundated by marine waters, and the limestone was deposited. This marine limestone contains a variety of invertebrate body fossils such as shells of brachiopods, clams, and gastropods (see Figure 3-8).

Figure 3-2. Horseshoe Crab Trace. Illustration by Mary Sundstrom.

Sedimentary structures such as ripple laminations and mud cracks, along with various trace fossils, can be used to define life zones on the tidal flat, shallow water zones, and tidal

Figure 3-3. Permian Tidal Flat. Illustration by Mary Sundstrom.

channels, allowing paleontologists and sedimentologists to refine models of Permian ecosystems. Animal tracks reveal how an animal lived and what its life was like and, perhaps, who was food for whom.

The BLM is directed by Section 2103 of Public Law 111-11 to conserve, protect, and enhance the resources and values of the Monument. Paleontological resources collected under a research permit would be stored in a Federally-approved repository for research and use in exhibits in order to meet the law's requirement to conserve these resources. This allows research on specimens stored away from forces of nature. These specimens can be, and are, exhibited to a wide range of people across the U.S.

The BLM policy for identifying paleontological sensitive geological formations is based on the Potential Fossil Yield Classification System (PFYC). Under the PFYC System, geologic units are classified based on the potential abundance of vertebrate fossils or uncommon invertebrate or plant fossils. It is not intended to be an assessment of whether important fossils are known to occur in these units, nor is it intended to be applied to specific sites or areas. In many situations, the classification should be an intermediate step in the analysis, and should be used to assess additional mitigation needs. Current BLM policy provides for a specific course of action depending on the paleontological resource potential ranked 1 through 5 (see Appendix D). The PFYC classes are depicted on Map 3-1 and defined as follows:

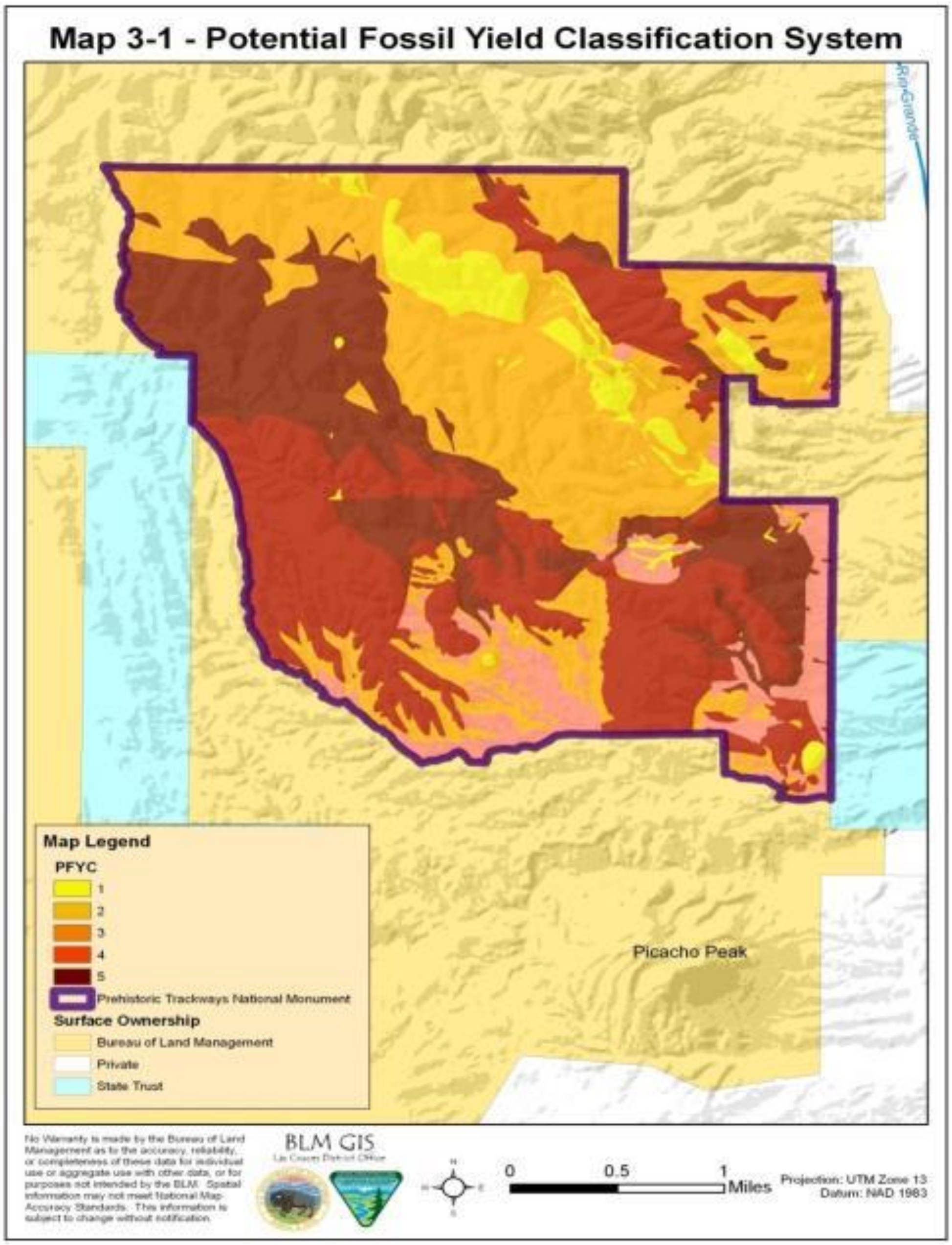
Class 1: Is composed of geologic units unlikely to contain recognizable fossil remains. This includes units that are igneous or metamorphic in origin (but excludes tuffs), as well as units that are Precambrian in age or older. Management concern for paleontological resources in Class 1 units is negligible or not applicable. No assessment or mitigation is needed except in very rare circumstances. The occurrence of significant fossils in Class 1 units is non-existent or extremely rare.

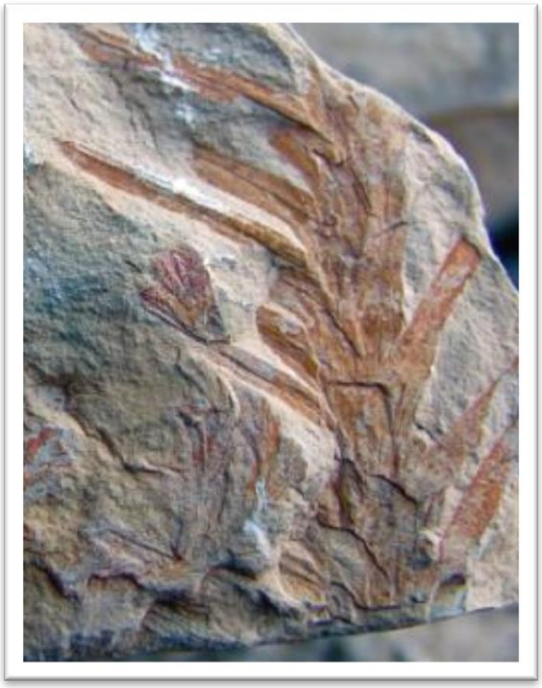
Class 2: Is composed of sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant invertebrate fossils. This includes units in which vertebrate or significant invertebrate fossils are unknown or very rare, units that are younger than 10,000 years before present, units that are aeolian in origin and units which exhibit significant physical changes in rock (i.e., compaction, cementation, mineral replacement). The potential for affecting vertebrate fossils or uncommon invertebrate or plant fossils is low. Management concern for paleontological resources is low, and management actions are not likely to be needed. Localities containing important resources may exist, but would be rare and would not influence the classification.

Class 3: Is composed of fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence; or sedimentary units of unknown fossil potential. These units are often marine in origin with sporadic known occurrences of vertebrate fossils. Vertebrate fossils and uncommon invertebrate fossils are known to occur inconsistently, and predictability is known to be low. Surface-disturbing activities will require sufficient assessment to determine whether significant fossil resources occur in the area of a proposed action, and whether the action could affect the paleontological resources.

<u>Class 4</u>: These are Class 5 geologic units (see below) that have lowered risks of human-caused adverse impacts or lowered risk of natural degradation. They include bedrock units with extensive soil or vegetative cover, bedrock exposures that are limited or not expected to be impacted, units with areas of exposed outcrop that are smaller than two contiguous acres, units in which outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic effects, and units where other characteristics are present that lower the vulnerability of both known and unidentified fossil localities.

<u>Class 5</u>:
Highly fossiliferous geologic units that regularly and predictably produce vertebrate fossils or uncommon invertebrate or plant fossils, and that are at risk of human-caused adverse impacts or natural degradation. These include units in which vertebrate fossils or uncommon invertebrate or plant fossils are known and documented to occur consistently, predictably, or abundantly. Class 5 pertains to highly sensitive units that are well exposed with little or no soil or vegetative cover, units in which outcrop areas are extensive, and exposed bedrock areas that are larger than two contiguous acres.





PHOTOS COURTESY OF:
JERRY MACDONALD

Figure 3-4 Leaf Fossils

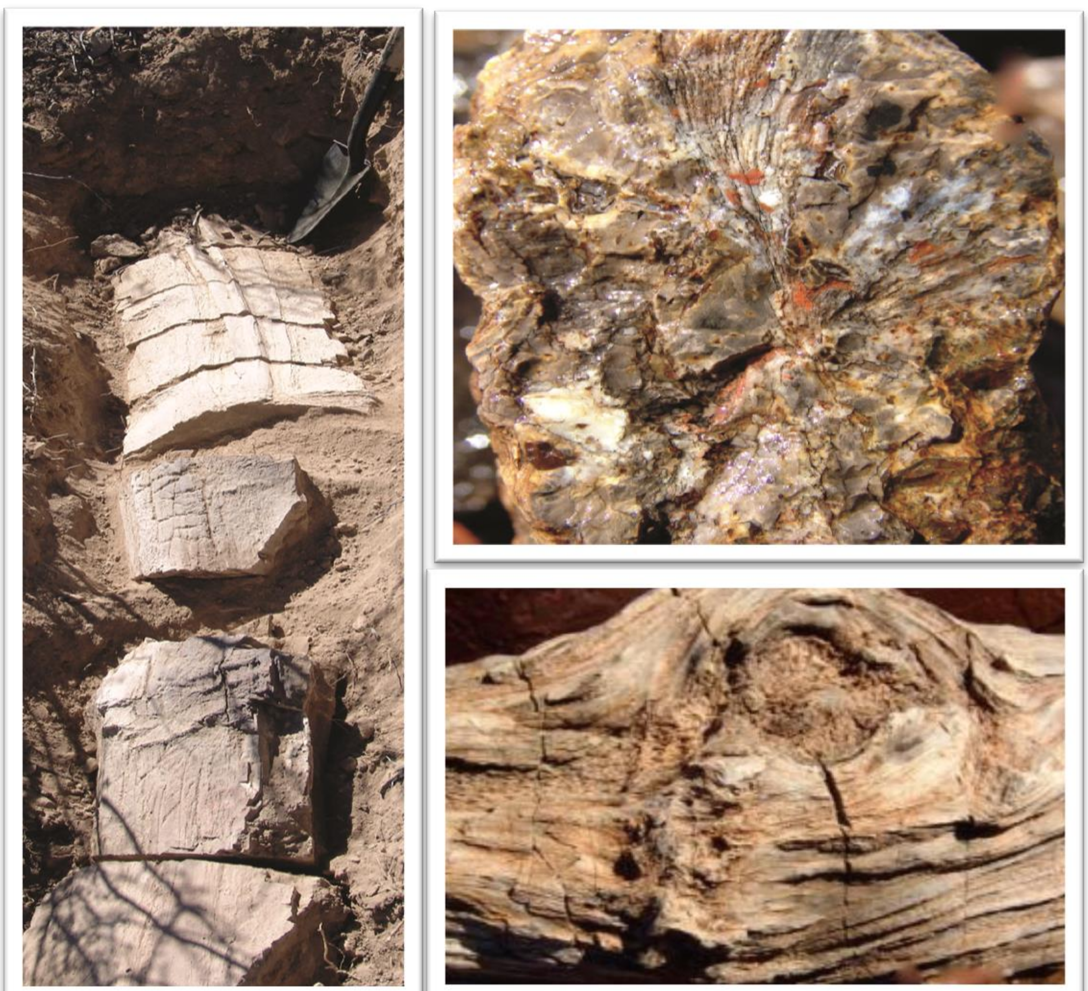


Figure 3-5 Petrified Wood

Figure 3-6 Walchia Fossils
Illustration by Mary Sundstrom
Photo by Spencer Lucas, New Mexico Museum of Natural History and Science

3.2.1.1 Non-Marine Fossils

3.2.1.1.1 Plant Fossils

The Robledo Mountains contain several important Lower Permian plant localities.

> *"Plants from the Robledo Mountains are primarily representatives of groups that we believe to have grown in seasonally dry habitats - commonly including conifers and an extinct group known as peltasperms, as well as other less abundant forms. Most of the plants grew along the margins of stream channels or in swampy lowlands, which is what permitted their leaves and branches to be buried quickly and in environments where they were removed from the effects of decay."*
>
> Bill DiMichele, PhD., Curator of Fossil Plants, Smithsonian Institution

3.2.1.1.2 Vertebrate Tracks

The most common ichnotaxon in the Robledo samples is the amphibian track type *Anthichnium salamdroide*. A large amphibian, ichnogenus *Limnopus* is represented and the diminutive amphibian ichnogenus *Erpetopus* is present. A few specimens suggest the presence of a larger amphibian track maker such as *Parabarpus*.

The most common small reptilian track type is *Dromopus lacertoides*, which occurs in large numbers on some layers at New Mexico Museum of Natural History (NMMNH) locality 846 (also termed the *Discovery Site* in the Jerry MacDonald Collection, see Figure 3-7).

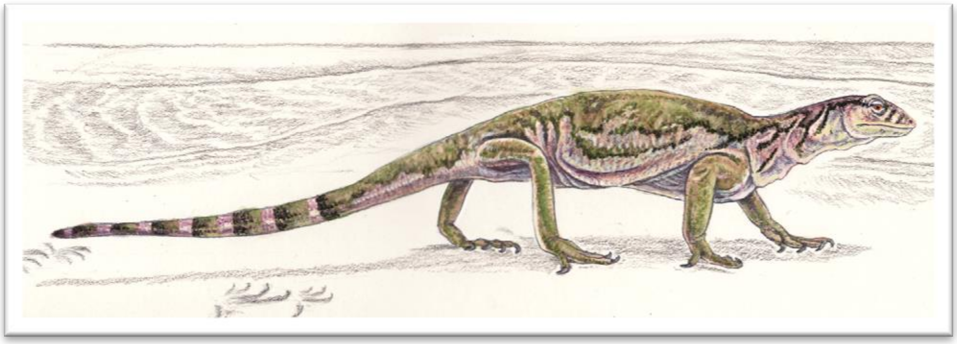



Figure 3-7. ***Dromopus***. Photo by Sebastian Voigt.
Illustration by Matt Celeskey, New Mexico Museum of Natural History and Science

3.2.1.1.3 Invertebrate Trackways

The invertebrate ichnofauna is particularly diverse and evidently includes many more than the 17 ichnotaxa described by Demathieu *et al*. (1992) from the Lower Permian of Southern France. Several described genera are present, whereas other morphologies probably represent new taxa. Minter and Braddy (2009) describe 18 types of invertebrate trace fossils from the Jerry MacDonald Collection.

3.2.1.2 <u>Marine Fossils</u>

Kues and Giles (2004) described and illustrated examples of the marine fauna represented in the Hueco Group in the Monument. More than 70 of the characteristic taxa are illustrated in the article and include brachiopods, bivalves and gastropods (see Figure 3-8) which are the most diverse elements of the fauna. Additionally, remains of sponges, corals, bryozoans, scaphopods, nautiloids, ammonoids, echinoids, crinoids, trilobites and sharks were found by Kues in the marine sequences. Ostracods are the most common microfossils in the Hueco Group in the Robledo Mountains. Some replacement of original minerals in the fossil shells has occurred and can obscure the original structure in some of the marine fauna.

Figure 3-8. Marine Fossils. Photo by Scott Elrick.

3.2.2 Education and Interpretation

Currently, there are no formal on-site interpretive facilities such as exhibits, kiosks or signs within the PTNM. There are no signed trails to lead visitors to any location within the PTNM. There is an informal trail to the *Discovery Site* which is marked with a sign that offers little in the way of interpretation. An information kiosk was installed on BLM land adjacent to the Monument in the winter of 2011 that offers orientation and interpretation of the Trackways. Within the Monument, guided hikes, tours, and school programs have been held for the past few years by the BLM and other educational entities from Las Cruces, such as the Museum of Nature and Science. Self-guided activities are taking place as well, but it is unknown how informative such excursions are for visitors.

Off-site programs have been on-going at various venues since the initial discovery of the Trackways. Originally, these programs were conducted by Jerry MacDonald. Since the designation of the Monument, the BLM and additional partners have carried on this practice. One of the local partners for interpretative and educational programs is the Las Cruces Museum of Nature and Science (MoNas). The Museum has been active in public education since the 1980's, and recently moved to a new and larger facility where they have expanded areas for the display of fossil specimens.

In 2011, the BLM formalized this partnership by entering into an Assistance Agreement with the City of Las Cruces to assist in the development of trackway exhibits for the new Museum which was in the planning stages. Today, the Museum displays a 30-foot long continuous Trackway specimen containing hundreds of tracks from several different animals from the Permian Era (Figure 3-9). This specimen is the centerpiece of the Museum whose theme is "*Trackways to Space*." In addition, there are several other displays interpreting the resources of the Monument including interactive videos of Jerry MacDonald discussing various aspects of his discoveries at the PTNM.

The MoNas is the in-town visitor center for the PTNM, offering formal educational and interpretive programs at the Museum. To continue and expand this partnership and in the interest of providing a link to the Monument itself, the BLM entered into a second Assistance Agreement with the City. The purpose of this Agreement is to continue supporting the MoNas in developing interpretative opportunities and providing information for informal (self-guided) and formal (Ranger or docent-led) touring opportunities.

Figure 3-9 The Trackways display at the Las Cruces Museum of Nature and Science.

Another partner that has been instrumental in providing educational and interpretive services and products is the New Mexico Museum of Natural History and Science (NMMNHS) in Albuquerque. This museum is currently the main curatorial facility housing most of the PTNM Trackway slabs. In 2012, an interpretive booklet was published by the NMMNHS through an Assistance Agreement with the BLM. The booklet, *Traces of a Permian Seacoast*, has been very popular with the public and is provided by the

BLM at no cost upon request. Through the same Agreement, the NMMNHS produced educational "*travelling trunks*" which have been located at several off-site venues since 2011. School kits are being developed in partnership with the BLM, NMMNHS and New Mexico State University. These items have enhanced the off-site programs that are supported by the BLM.

Another key partner for the PTNM is the Paleozoic Trackways Foundation of Las Cruces. This group has assisted in raising funds in support of educational programs concerning the PTNM including funding for school buses for field trips to the Monument for Ranger-led tours. They provide outreach and information at many local public venues. Also, the PTNM is a BLM Hands-on-the-Land site which is a National network of outdoor classrooms on public land. These classrooms provide field-based opportunities that address the Science, Technology, Engineering and Mathematics (STEM) programs and curriculum.

3.2.3 Recreation and Visitor Services

The Monument is near Las Cruces, New Mexico. It has been recognized for decades as an easily accessible area to enjoy a variety of outdoor activities. Visitors use the area to hike, mountain bike, drive on OHV trails, horseback ride and more. Since Jerry MacDonald began excavating in the late 1980s, his "*Discovery Site*" has been a popular attraction for people to hike to and view fossil tracks. New Mexico State University has been taking geology classes out to the Robledo Mountains for decades to explore the unique geological features. There are currently no facilities within the Monument to support these uses. As the Monument becomes more widely known, it is reasonable to anticipate an increasing demand for on-site facilities.

Visitation numbers to the Monument and its immediate environs are estimated at 25,000. From August 2011 to August 2012, TRAFx vehicle counters were placed at three strategic locations to estimate the number of visitors entering the Monument. One counter was placed at the cattle guard on Permian Tracks Road (see Map 2-1) and over 10,000 vehicles were counted. This cattle guard is outside the Monument at a juncture where cars may continue into the Monument or park outside the Monument and enter it by foot, bike, OHV, or horse. This spot is also a popular area for target shooting during the day, and parties during the night. It is certain that many of the vehicles that crossed over the vehicle counter on Permian Tracks Road were not destined for the Monument proper.

Placement of the two other counters allows the BLM to estimate that from 40 to 60 percent of vehicles that crossed the cattle guard entered the Monument on OHV routes. The standard conversion for recreational visits per vehicle is 2.5 meaning that perhaps 25,000 visitors crossed the vehicle counter and anywhere from 10,000 to 15,000 people came into the Monument. Various other unimproved routes access the Monument so there may be an even higher number of visits into the Monument that are unaccounted.

The Monument offers a variety of informal hiking trails, paths, and canyon bottoms that appeal to outdoor enthusiasts. Hikers, horse riders, recreational firearms users, OHV enthusiasts, amateur fossil and rock collectors, geologists, paleontologists, photographers, cyclists, and dirt bike riders are all attracted to the rustic, yet convenient foothills of the southern Robledo Mountains. Hikers and bicyclists usually follow the arroyos and ridgelines and often use the same trails as the OHV drivers.

Recreational target shooting and hunting is allowed in the Monument. Target shooting is popular adjacent to the Monument, in the vicinity of the cattle guard on Permian Tracks Road (see Map 2-1). Visitors, educational groups, and staff members have reported safety risks from target shooters. Hunting occurs during deer hunting season and year-round for non-game species such as jackrabbits, squirrels, and coyotes.

Campfire remains and large amounts of debris associated with partying around the Monument are frequently noted and cleaned up by BLM staff and concerned public.

3.2.4 Trails and Travel Management

In 1997, in order to reduce motorized vehicle incursions into the Robledo Mountains Wilderness Study Area (WSA) and to provide a convenient venue for OHV enthusiasts, the BLM prepared the Robledo Mountains Off-Highway Vehicle Implementation Plan (NM-036-97-083). This trail system is open year-around and has been popularized by the annual Chile Challenge Extreme Off-Road Event. About 32 miles of the Robledo Mountains OHV trails are within the boundaries of the Monument. The variety of extreme "*rock crawling*" trails coupled with a network of unmaintained two-track routes has made the Robledo Mountains a favorite destination for OHV use.

The Monument is characterized by rugged, challenging terrain that incorporates approximately 32 miles of OHV trails. All of the routes within the Monument require high clearance, four-wheel drive vehicles. Nearly half of these trails are rated as extreme or difficult, and require modified vehicles, knowledge, and skills. The rest of the trails are rated as easy or moderate but still require a certain degree of skill and four-wheel drive vehicles. Low clearance, two-wheel drive vehicles cannot safely negotiate these trails.

In 1998, the BLM completed an environmental assessment (NM-036-98-29) to identify and authorize mountain bike trails in Doña Ana County. Among the trails that were approved for development through this analysis was the 4-mile (round trip) route in the southern Robledo Mountains that is popularly known as the *SST* Trail. Since 1998, the *SST* has evolved to incorporate a portion of a designated OHV trail bringing the total round trip distance to 6.5 miles, of which 5.5 miles are within the Monument.

The PTNM is currently open for casual equestrian use and hiking, although no formal trails are designated for those uses.

3.2.5 Air Resources

3.2.5.1 Air Quality

The Clean Air Act, as amended, requires the Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) for six "*criteria*" pollutants including Carbon Monoxide, Lead, Nitrogen Dioxide, Sulfur Dioxide, Ozone, and Particulate Matter (PM). Of these six, only one – PM – is substantially affected by natural resource management activities proposed in the *Analysis Area*. PM is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. Vehicle exhaust emissions, such as NOx, CO, Volatile Organic Compounds and Hazardous Air Pollutants, may result from natural resource management activities proposed in the Analysis Area as well. NOx and VOC emissions may combine in the presence of sunlight to form ozone.

The size of particles is directly linked to their potential for causing health problems. EPA is concerned about particles that are 10 micrometers in diameter or smaller (PM_{10}) because those are the particles that generally pass through the throat and nose and enter the lungs. A separate standard has been set for $PM_{2.5}$, those particles with diameter of 2.5 micrometers or less, because they have been found to cause the most serious health impacts. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. Units of measure for the PM are micrograms per cubic meter of air ($\mu g/m^3$). (http://www.epa.gov/air/criteria.html)

Air quality monitoring stations measure concentrations of PM throughout the country; Doña Ana County currently has several. Two monitoring stations for PM_{10} can be considered representative of the *Analysis Area*. The West Mesa site is located approximately 6 miles south of the *Planning Area* and the Holman Road Site is approximately 12 miles to the east-northeast. In addition, $PM_{2.5}$ is monitored in Las Cruces approximately7 miles to the southeast. A review of 2010-2012 data indicates that the $PM_{2.5}$ levels have remained well within the standards set by the New Mexico Environment Department, as shown in Table 3.1. There are no CO and NO_2 monitors in the Las Cruces area.

Table 3-1 2010-2012 Design Values for Las Cruces, NM

TABLE 3-1 2010-2012 DESIGN VALUES FOR LAS CRUCES, NM				
POLLUTANT	DESIGN VALUE	AVERAGING PERIOD	NAAQS	NMAAQS
$PM_{2.5}$	5.7 $\mu g/m^3$	Annual	12.0 $\mu g/m^{3,1}$	
$PM_{2.5}$	12.0 $\mu g/m^3$	24-hour	35 $\mu g/m^{3,2}$	
O_3	0.065 ppm	8-hour	0.075 ppm[3]	
Source: http://www.epa.gov/airtrends/values.html Notes: [1] 3-year average of the annual mean [2] 3-year average of the 98th percentile [3] 3-year average of the 4th highest daily maximum 8-hour ozone concentration				

A review of PM_{10} monitoring data for Dona Ana County (http://www.epa.gov/airtrends/values.html) shows that several monitoring sites in the county recorded exceedances of the 24-hour NAAQS. The New Mexico Environment Department recently published a study showing that 2008 exceedances of the PM_{10} standards were associated with regional dust storms and not human activities in Doña Ana County (NMED 2011). Southern Doña Ana County is also impacted by industrial sources in Mexico and Texas as well as in the Sunland Park and Anthony areas south of Las Cruces. A small area around the community of Anthony, approximately 30 miles southeast of the *Planning Area*, is designated as nonattainment for the PM_{10} standard. In addition, an area in the corridor from Anthony south to Sunland Park is currently considered a maintenance area for ozone.

According to the 2011 National Emissions Inventory, the emissions of criteria pollutants, Volatile Organic Compounds (VOCs) and Hazardous Air Pollutants (HAPs) in Doña Ana County are primarily from biogenic sources, fire, mobile sources and dust. Annual emissions of criteria pollutants and HAPs for 2011 in Doña Ana County are:

- 51,899.4 tons CO;
- 10,541.94 tons NO2;
- 66,038.36 tons PM10;
- 8,340.40 tons PM2.5,
- 209.4 tons So2
- 65,772.4 tons VOC

Data were taken from the following website: http://www.epa.gov/ttn/chief/net/2011inventory.html. The state of New Mexico is in the midst of a multi-year drought, which means soils in the State are particularly dry. This condition may lead to more wind-blown dust events where PM concentrations are elevated because dry soils are more susceptible to becoming airborne. It is not possible to predict when the current drought will end.

The EPA conducts a periodic National Air Toxics Assessment (NATA) that quantifies HAP emissions by county in the U.S. The purpose of the NATA is to identify areas where HAP emissions result in high health risks and further emissions reduction strategies are necessary. According to the 2005 NATA (http://www.epa.gov/ttn/atw/nata2005/05pdf/sum_results.pdf), Doña Ana County has a cancer risk of 25-50 in a million and 0-1 respiratory hazard index. These levels are considerably lower than metropolitan areas in the region.

The closest Class I area, as defined by the Clean Air Act, is the Gila Wilderness Area, which is 75 air miles distant from the Monument.

3.2.5.2 Climate

The PTNM has an arid continental climate with hot summers and mild winters. Summers are known for hot weather, with extended periods of over 100°F (38°C) and the latter half of the summer seeing increased humidity and frequent afternoon thunderstorms. Autumn brings cooler temperatures, although still warm and with decreased precipitation. Winter conditions fluctuate between warm and sunny to cool and windy. Average winter temperatures range from minimums in the upper 20s to maximums in the mid- to upper 50s. Spring is known for its high winds in the afternoons and warmer weather. Average annual precipitation ranges from 8 to 14 inches. Precipitation mainly comes in the form of thunderstorms associated with the Southwest monsoon in the summer, with showers throughout the year as Pacific weather systems dip south. An average freeze-free period from 200 to 240 days occurs in most of the area. Light snowfall occurs most winters but is usually short-lived. Table 3-2 shows average monthly temperature and precipitation for 1981-2010 measured at New Mexico State University in Las Cruces.

Table 3-2 Average Temperature and Precipitation for Las Cruces 1981-2010

TABLE 3-2 AVERAGE TEMPERATURE AND PRECIPITATION FOR LAS CRUCES 1981-2010												
LAS CRUCES	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**
Average Temperature (^oF)	43.8	48.1	54.1	61.4	70.2	78.6	81.4	79.4	73.8	63.0	51.5	43.5
Average Max Temperature (^oF)	58.6	63.5	70.1	77.8	86.8	94.8	94.9	92.1	87.7	78.6	67.3	57.8
Average Min Temperature (^oF)	29.1	32.7	38.2	44.9	53.7	62.4	68.0	66.8	59.9	47.4	35.7	29.1
Precipitation (inches)	0.51	0.41	0.22	0.29	0.40	0.66	1.53	2.22	1.33	0.94	0.46	0.77
Source: NOAA, 2011.												

In addition to the air quality information cited above, new information about greenhouse gases (GHGs) and their effects on national and global climate conditions has emerged. Global mean surface temperatures increased nearly 1.0°C (1.8°F) from 1890 to 2006 (Goddard Institute for Space Studies, 2007). However, observations and predictive models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Without additional meteorological monitoring and modeling systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions; what is known is that increasing concentrations of GHGs are likely to accelerate the rate of climate change.

Greenhouse gases that are included in the US Greenhouse Gas Inventory are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6), CO_2 and methane (CH_4) are typically emitted from combustion activities or are directly emitted into the atmosphere. On-going scientific research has identified the potential impacts of greenhouse gas emissions (including CO_2; CH_4; nitrous oxide (N_2O), and several trace gasses) on global climate. Through complex interactions on regional and global scales, these greenhouse gas emissions cause a net warming effect of the atmosphere (which makes surface temperatures suitable for life on Earth), primarily by decreasing the amount of heat energy radiated by the Earth back into space. Although greenhouse gas levels have varied for millennia (along with corresponding variations in climatic conditions), recent industrialization and burning of fossil carbon sources have caused CO_2 concentrations to increase dramatically, and are likely to contribute to overall climatic changes. Increasing CO_2 concentrations may also lead to preferential fertilization and growth of specific plant species.

In 2007, the Intergovernmental Panel on Climate Change (IPCC) predicted that by the year 2100, global average surface temperatures would increase 1.4 to 5.8°C (2.5 to 10.4°F) above 1990 levels. The National Academy of Sciences (2006) supports these predictions, but has acknowledged that there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature will not be equally distributed, but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures are more likely than increases in daily maximum temperatures. It is not, however, possible at this time to predict with any certainty the causal connection of site specific emissions from sources to impacts on the global/regional climate relative to the proposed lease parcels and subsequent actions of oil and gas development.

Mean annual temperatures have risen across New Mexico and the southwestern U.S. since the early 20th century. When compared to baseline information, periods between 1991 and 2005 show temperature increases in over 95 percent of the geographical area of New Mexico. Warming is greatest in the northwestern, central, and southwestern parts of the State. Recurrent research has indicated that predicting the future effects of climate change and subsequent challenges of managing resources in the Southwest is not feasible at this time (IPCC, 2007; CCSP, 2008). However, it has been noted that forests at higher elevations in New Mexico, for example, have been exposed to warmer and drier conditions over a ten year period. Should the trend continue, the habitats and identified drought sensitive species in these forested areas and higher elevations may also be affected by climate change (Enquist and Gori, 2008).

A number of activities contribute to the phenomenon of climate change, including emissions of GHGs (especially carbon dioxide and methane) from fossil fuel development, large wildfires, activities using combustion engines, changes to the natural carbon cycle, and changes to radiative forces and reflectivity (albedo). It is important to note that GHGs will have a sustained climatic impact over different temporal scales due to their differences in global warming potential (described above) and lifespans in the atmosphere.

Climate change is expected to result in increasingly frequent and intense extreme heat events, which will worsen drought and increase wildfire risks in New Mexico. As well, increasing and more intense heat events are projected to increase ozone concentrations by 1-10 ppb this century according to the draft Third National Climate Assessment and Development Advisory Committee report (http://ncadac.globalchange.gov/). Increased drought and areas where wildfire has resulted in a loss of vegetation will be further susceptible to wind events where soils easily become airborne and measured PM concentrations are elevated.

3.2.6 Cultural Resources

The cultural resources of the Monument are not well known; less than one percent of the Monument has been inventoried. Four linear inventories have been conducted for a bike trail and for grazing improvements. Only one archaeological site was identified during these inventories. This site, LA 53790, is described as a lithic scatter of less than 10 artifacts with an unknown time period.

Socio-cultural properties, also known as traditional cultural use areas, are those places of traditional cultural significance to American Indians and others. Such properties may exist within the boundaries of the PTNM, but no specific place or resource has yet to be identified during formal consultation.

Cultural resources include archaeological, historic, and socio-cultural properties. Archaeological resources generally refer to prehistoric sites while historic resources refer to those for which some form of written record exists. Socio-cultural properties refer to areas of concern to Americans Indians, and other cultural groups, that are significant to heritage or spiritual and cultural practices.

There are several distinct periods or traditions that are discernible in the archaeological records for the *Analysis Area* generally. The earliest occupation occurred from about 9,500 BC to approximately 6,000 BC. This period is known as the Paleo-Indian period. The period is divided into three traditions: Clovis, Folsom, and Plano. Each tradition is associated with distinctive projectile points and lithic tool kits. Isolated project points from these traditions have been found within the larger region. Paleo-Indian people are thought to have been mobile hunters and gatherers who focused on migratory big game.

The second prehistoric period is referred to as the Archaic or Desert Archaic. The Archaic cultures are believed to have occupied the larger area from around 6,000 BC to about 100 AD. Archaic cultures are believed to have been non-sedentary, pre-pottery hunters and gatherers with a growing emphasis on territoriality and home bases and plant gathering leading to plant cultivation. The origins of agriculture in the Southwest United States begin during this period. The Archaic cultures are known for a suite of projectile points that define sites as well as other lithic tools and organic remains in the form of basketry, sandals, and other textiles that have survived owing to the dry conditions of this area.

The third period or tradition has been identified as the Mogollon. The Mogollon cultural region has been divided into the Western Mogollon and eastern or Jornada Branch of the Mogollon. This period is also known as the Formative Period. This tradition begins at approximately 200 AD and extends to approximately 1450 AD. Within this time period, several distinct changes begin to occur in the archaeological record:

1. Agriculture becomes the basic element of the economy although supplemented by hunting and gathering in varying degrees;
2. Pottery is introduced and soon divides into technological and distinctive artistic/stylistic traditions;
3. Pithouse hamlets aggregate into sedentary pithouse villages;
4. These communities in turn begin to construct above ground residences known as pueblos of either masonry or adobe; and
5. Interregional contact and trade are more evident, at least in the archaeological record, than heretofore.

The Mogollon Period ends at 1450 to 1500 AD. There appears to be a complete break in occupation although this may be more apparent than real. This period is succeeded by the Protohistoric Period or that period just before and phasing into the Historic Period. The Protohistoric occurs between 1540 and 1680 AD for this area. Several named Protohistoric groups are recorded for the area and appear to have practiced a hunting and gathering economy. During this period, various peoples that would become the historic Apaches move into the *Analysis Area* from the west and northwest displacing or absorbing the peoples in their path. The Chiricahua Apache occupation of the area continued into the Historic Period until 1890. The Apache were mobile hunters and gatherers and, increasingly during the Historic Period, depended on raiding to supplement their economy.

Following its initial population by Native Americans, the Mesilla Valley was inhabited by the Spanish party of Friar Agustin Rodríguez in 1581. After the 1848 Treaty of Guadalupe Hidalgo, which signaled the end of the Mexican War, a colony of individuals not desiring American citizenship moved across the Rio Grande and established the town of Mesilla.

The Mesilla Valley has experienced the broad trends of the Historic Period but permanent settlement and development only occurred in the 1850s. Fierce Apache resistance to European encroachment inhibited any permanent settlement. However, all broad historic trends are represented in the historical record and include the establishment and use of El Camino Real de Tierra Adentro, the founding of towns and agriculture, military forts and the Apache wars, the Civil War, and mining and ranching, into the events of the 20th century. The primary historic use of the PTNM was grazing.

The Mesilla area was seen as an ideal location for a railroad route to the Pacific, which would connect the rest of the United States to California. The Gadsden Treaty was signed on December 30, 1853, resulting in the addition of Mesilla to Doña Ana County. The railroad was routed through Las Cruces instead, and that city eventually replaced Mesilla as the County seat. This has brought settlement and human influence and use to Doña Ana County, which includes the Robledo Mountains.

One historic feature within the Monument is Apache Dam. Apache Dam was constructed by the Civilian Conservation Corps from Camp BR-39, Las Cruces, New Mexico, in 1936 and was constructed to control arroyo flooding that threatened the Picacho Canal and farmland in the Mesilla Valley. Two other unnamed dams in support of Apache Dam were constructed as well.

3.2.7 Geology/Minerals

This section discusses the physiography, rock units, geologic structure and tectonic history of the region.

The Monument is situated within the North American Basin and Range Province and the dominant tectonic feature is the Rio Grande Rift. The Rio Grande Rift is a geographically extensive extensional basin associated with the most recent phase (spanning ~ 30 million years ago to present) of crustal thinning in the Southwest Basin and Range Province. The closely-spaced normal faulting and domino-style block tilting along the north-south rift axis is caused by extension of the upper crust, which is being driven by the plastic flow of hotter rocks at depth (New Mexico Bureau of Geology and Mineral Resources 2003). The rift system is superimposed on a weakened crustal region of faults that were active during Pennsylvanian-age Tectonism (318 to 299 million years ago). Block-faulted, uplifted mountains including the Robledo Mountains are located on both sides of the Rio Grande Rift.

The Trackways Discovery Site and other tracksite locations in the Robledo Mountains are red-colored sandstones referred to as the Abo Formation of the Hueco Group (see Figure 3-10). In the Robledo Mountains, the Hueco Group consists primarily of limestone and fine-grained clastics (sandstones and shales) deposited in a shallow marine environment. Rocks of the Abo Formation contain both fossiliferous marine limestone and shale and red silty-sandstone deposited in a tidal flat environment.

It is this sandstone which hosts the fossil trackways (Kues and Giles 2004). These strata along with an overlying upper member of the Hueco Group represent a regional transition zone between marine limestone of the Hueco Group to the south and non-marine red beds of the Abo Formation to the north (Lucas *et al.* 1994).

Figure 3-10 The "*red beds*" of the Abo Formation found in the Prehistoric Trackways National Monument.

The Abo Formation and Hueco Group were deposited during the early Permian Period at the end of the Paleozoic Era, over 250 million years ago. Younger rocks are also found in the Robledo Mountains. In the southern part of the Range, conglomerates, gypsiferous sandstones and mudstones occur in association with the Love Ranch Formation and the Palm Park Formation. These rocks were probably deposited during the Eocene Period between 55 and 51 million years ago. Volcanic rocks were emplaced in the northern part of the Robledo Mountains during at least two episodes around 35 million years ago and 7 million years ago. The youngest rocks in the Monument consist of landslide deposits, valley-fill deposits and stream-channel gravels in boulders generally deposited less than 5 million years ago (Seager *et al.* 2008).

The historical record of earthquakes in the Rio Grande Rift system from 1962 through 1998 lists only four earthquakes of magnitude 3.0 or greater. Those earthquakes were located north and east of Las Cruces (Sanford *et al.* 2002). Although New Mexico is in a seismically active area, the average earthquake intensity is a moderate 4.5 on the Richter scale. As such, a strong, damaging earthquake is not likely to occur in the Monument. In parts of the Monument, steep slopes and the presence of the friable, easily weathered Abo Formation may create local concerns with slope stability and landslide potential.

Sedimentary-hosted iron deposits were discovered in the southwestern Robledo Mountains (Iron Hill District) in the early 1930s (McLemore 1998; McLemore *et al.* 2005). Iron deposits consist predominately of iron-oxide minerals and occur in Hueco Formation Group limestone. Inferred ore reserves are estimated at approximately 15,000 short tons, but future development of these deposits is unlikely due to small tonnages, low grade and inaccessibility. Travertine was also mined sporadically from the southwest Robledo Mountains, and gypsum deposits have been found but have not been exploited (McLemore 1998).

Chemical analysis suggests that the Hueco Formation in Apache Canyon may have potential as a source of high-calcium limestone (McLemore 1998). Historically, the most important mineral resource in the Robledo Mountains has been building stone from the south central portions of the Range. A rock quarry outside the eastern boundary of the Monument, known as Community Pit #1, was the source for sandstone and siltstone used in retaining walls, decorative walls, and in general landscaping.

Community Pit #1 was in production for approximately 40 years (beginning in 1969) and, according to the quarry operators, most of the rock produced (probably less than 1 million tons) was used locally. Past mining practices at the quarry have left it with unsafe vertical high walls, which pose a safety concern. Significant fossil trackways have been found in siltstone and sandstone at and near the quarry. Although excavation at the quarry has led to additional findings, there are concerns in the academic community that continued mining could harm undiscovered specimens. The Community Pit #1 is now closed to public access due to safety concerns. An environmental assessment analyzing reclamation of the Community Pit was completed in 2010.

Small volumes of landscape rock have also been mined in Apache Canyon, just south of the Monument. The BLM authorized extraction of building stone material at the quarry, known as Apache Canyon, prior to 2000. This quarry was active until the BLM did not renew the permit in February 2011. The proximity to the Monument and regular discovery of fossils at the quarry's edge was the logic for its closure. The excavations and use of this area has exposed fossils and created parking areas that in the future may potentially be an interpretation and educational resource, even though this area is outside of the Monument boundary.

Other than for building stone, there has not been much interest in the minerals of the Robledo Mountains. There are no existing mining claims within the Monument boundary. The designating Legislation withdrew all Federal minerals within the Monument from mineral entry, which means that mineral exploration or removal is not allowed. In the southern portion of the Monument, there are 368 acres of non-Federal minerals to which the mineral withdrawal does not apply unless acquired by the Federal government and included into the Monument.

3.2.8 Lands and Realty

Public land within the National Monument is withdrawn from entry, appropriation, or disposal under the public land laws as directed by the Legislation. There are no rights-of-way (ROWs) within PTNM.

BLM establishes right-of-way exclusion and avoidance areas to guide decisions about where ROWs may be granted. In exclusion areas, no ROWs are allowed unless mandated by law; in avoidance areas, ROWs may be granted only when no feasible alternative route (or designated ROW corridor) is available (BLM 1993). ROW exclusion areas within the Monument include the Robledo Mountains ACEC and Paleozoic Trackways RNA. ROW avoidance areas include Visual Resource Management Class II areas.

Acquisition of an easement across private land for access to public land leading into the Robledo Mountains (PTNM) is a specific management decision (*Mimbres RMP*, p.2-20).

3.2.9 Lands with Wilderness Characteristics

FLPMA requires the BLM to maintain a current inventory of land under its jurisdiction and identify within that inventory lands with wilderness characteristics outside of areas designated WSAs. Through the land use planning process, the BLM can make a decision to protect lands with wilderness characteristics or to allocate those lands for other uses.

Within the Monument, there are no areas outside of the Robledo Mountains WSA being managed for wilderness characteristics; however, the values of naturalness, opportunities for outstanding solitude, or opportunities for primitive and unconfined recreation, as defined by *BLM Instruction Memorandum 2011-154,* are present. The BLM conducted a wilderness inventory of the Monument in January 2011, which identified 576 acres that are contiguous to the Robledo Mountains WSA as having wilderness characteristics (Map 3-2). The rest of the Monument was determined not to be of sufficient size to meet the criteria for wilderness characteristics (4,311 acres).

3.2.10 Livestock Grazing

Ranching and livestock grazing have been predominant in the area since the 1880s, when railroads arrived in the territory. Grazing on public land has been authorized and numerous range improvements such as fencing and watering sources have been developed. Most of the land administered by the BLM in the *Analysis Area* is grazed by livestock. The Monument is permitted to two different livestock operators in two separate allotments. Portions of the Picacho Peak Allotment (03008) and the Altamira Ranch (03040) are within the National Monument (see Map 3-3). Both grazing allotments are administered under Section 3 of the Taylor Grazing Act, as they are within the boundaries of the established grazing district. Land status of the allotments is shown in Table 3-3.

Approximately 748 acres of public land in the National Monument are within the Altamira Ranch Allotment and 4,505 acres of public land in the Monument are within the Picacho Peak Allotment. Range improvements such as water developments and fences are associated with the allotments (Table 3-4).

The current grazing permit for the Picacho Peak Allotment allows 89 cattle to graze the allotment yearlong for a total of 822 active animal unit months (AUMs) at 77 percent public land use. An additional 152 AUMs have previously been put into suspended use as a result of changes to allotment boundaries from land exchanges and other land use changes on private land. The Altamira Ranch Allotment is permitted to run 54 cattle yearlong for a total of 635 active AUMs at 98 percent public land use.

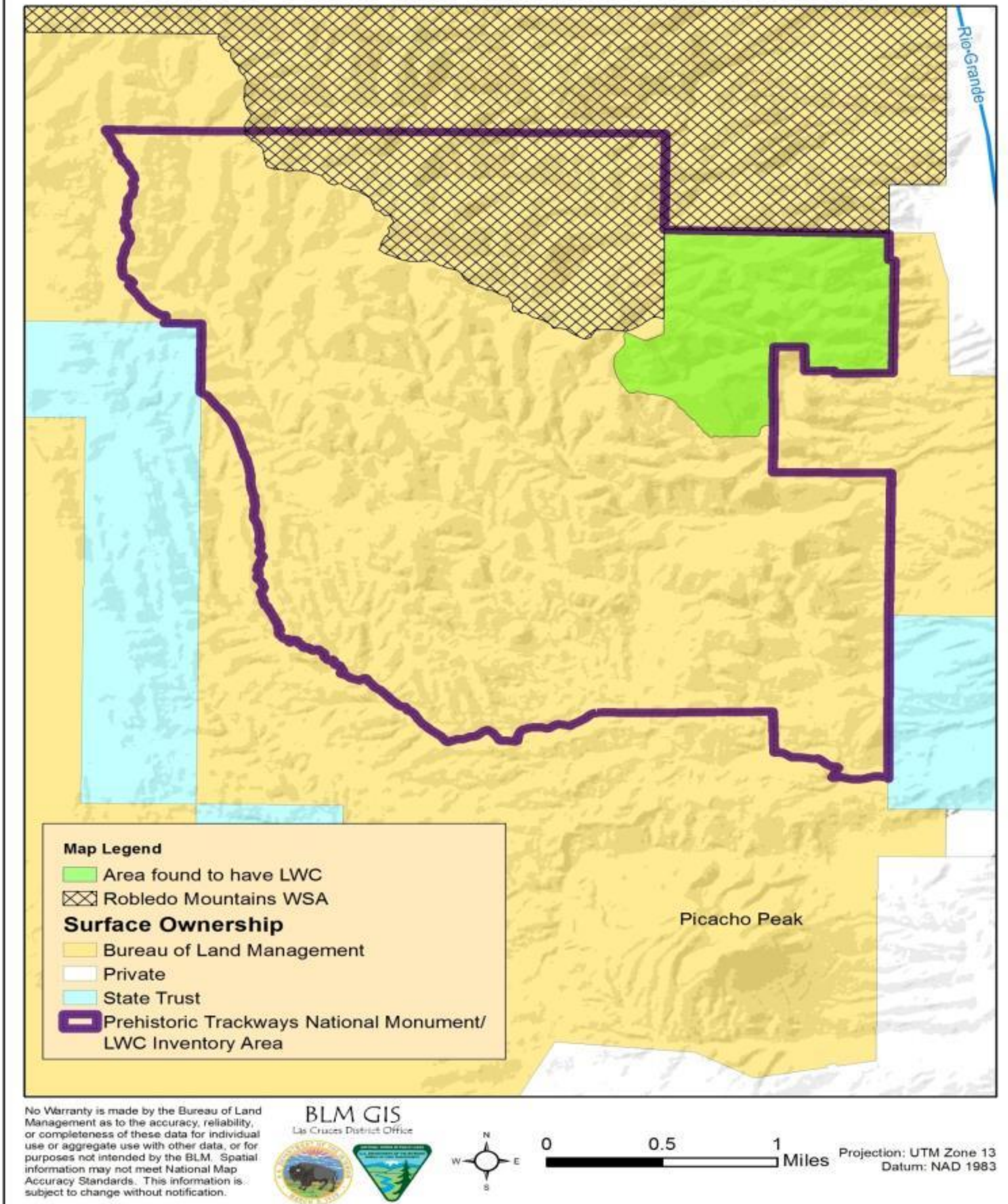
Table 3-3 Land Status of Grazing Allotments within the PTNM

TABLE 3-3 LAND STATUS OF GRAZING ALLOTMENTS WITHIN THE PTNM		
Land Status	**Picacho Peak (acres)**	**Altamira (acres)**
Federal Range	11,235	8,988
Deeded Private Land	55	74
State Trust Lands Leased by Permittee	1,047	-
State Trust Land Not Leased by Permittee	180	1,028
Private Land Not Leased by Permittee	1,492	375
Total Surface Acres	14,009	10,090
Federal range inside PTNM	4,505	748

At current carrying capacity, a total of 143 cattle are authorized to graze on the two allotments. A total of 456 AUMs of forage are available for livestock grazing on an annual basis on public land within the Monument. Approximately 395 AUMs within the Monument boundary are associated with acreage on the Picacho Peak Allotment, and the remaining 61 AUMs are allotted to Altamira. However, actual use on the Monument is much less than what is authorized under the current grazing permits. Since the revision of the allotment management plan in 1997, the Picacho Peak Allotment has been conservatively stocked up to approximately 58 percent of the authorized carrying capacity on a voluntary basis.

Under the current rotation system, cattle typically graze the Monument from the beginning of April to the beginning of November annually. Quantification of livestock use on the Monument from the Altamira Ranch Allotment is difficult due to the lack of actual use data for the allotment; however, conversations with the grazing permittee have confirmed that cattle spend most of the year on the northern part of the allotment, and the southern part where the Monument is located is seldom used. The main reasons that cattle do not typically use this part of the allotment are the lack of water developments and reliable water sources and the rugged terrain.

Map 3-2 - Lands with Wilderness Characteristics



Map 3-3 - Livestock Grazing Allotments

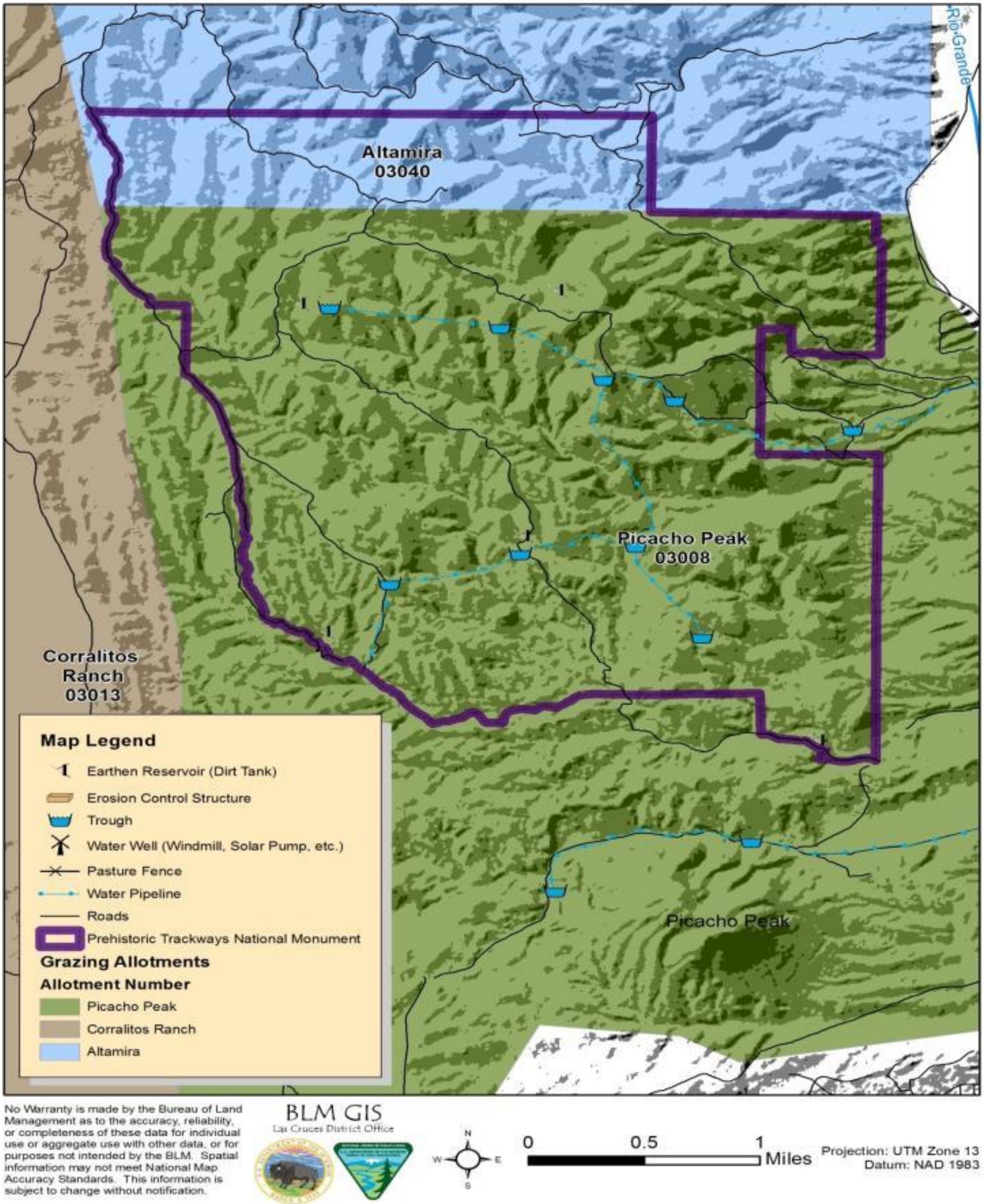


Table 3-4 Range Improvements within the Prehistoric Trackways National Monument

TABLE 3-4 RANGE IMPROVEMENTS WITHIN THE PREHISTORIC TRACKWAYS NATIONAL MONUMENT						
ALLOTMENT	**PROJECT**	**UNITS**	**LOCATION**	**AUTHORIZATION**	**DATE**	**CONDITION**
PICACHO PEAK	Baker Reservoir 1	1 each	T. 22 S., R. 1 W., Sec. 25	Range Improvement Permit	1943	Good
	Robledo Interior Fence	3 miles	T. 22 S., R. 1 E., Sec. 31 T. 22 S., R. 1 W., Secs. 35, 36	Cooperative Agreement	1987	Good
	Burke Tanks	2 each	T. 22 S., R. 1 W., Secs. 23 and 24	Range Improvement Permit	1972	Good
	Robledo Pipeline	2.3 miles 1 storage 3 troughs	T. 22 S., R. 1 E., Secs. 19, 20, 29, 30 T 22 S, R 1, Sec. 24	Range Improvement Permit	1984	Good
	Robledo Pipeline Extension 2	0.25 mile 2 troughs	T. 22 S., R. 1 W., Secs. 23, 24	Range Improvement Permit	1991	Trough Maintenance Needed
	Robledo Pipeline Extension 1	4.5 miles 5 Troughs	T. 22 S., R. 1 W., Secs. 24, 25, 26, 35, 36 T. 22 S., R. 1 E., Secs. 30, 31	Cooperative Agreement	1989	Good
ALTAMIRA RANCH	NO PROJECTS					

The northern portion of the Picacho Peak Allotment contains a network of pipelines, a water storage tank, and troughs constructed in order to improve cattle distribution to attain proper forage utilization. The water source for these improvements is a well on private land outside of the Monument. Watering facilities have not been developed in the southern end of Altamira Ranch Allotment.

The Picacho Peak Allotment is divided into two main pastures, with the pasture division fence running in an east/west direction close to the southern Monument boundary. The majority of the Monument is located in the northern pasture of the Picacho Peak Allotment, with two small areas to the south separated by the main pasture fence. The allotments have some boundary fencing which lies close to the Monument; however, the majority of the allotment boundary between the Picacho Peak and Altamira Ranch Allotments is not fenced. In addition, the terrain in this location is typically too rough for cattle to move freely between the allotments.

Based on the most recent monitoring data and confirmed by subsequent allotment inspections, the majority of this northern pasture of the Picacho Peak Allotment is lightly utilized. The southern part of the Altamira Allotment is not routinely utilized by cattle due to the rough terrain and lack of water, and may only see slight use from occasional cattle that could drift into the area. Therefore, livestock use of the Monument is light; grazing intensity may occur at a more moderate level near watering points, but most places see slight to light use by livestock due to terrain. This is based on both historic utilization data and more recent observations during range health assessments and allotment inspections.

3.2.11 Science and Research Management

Research proposals are approved by the BLM Regional Paleontologist and are authorized on a case-by-case basis. Several research projects within the Monument have increased the scientific information about Permian Age animal and plant life. Approximately 140 paleontological sites have been documented within the Monument and over 3,000 acres of the Monument have been surveyed for paleontological resources as of Fall 2010. The BLM has partnerships with natural history museums and institutions to increase research and to educate the public about the scientific findings. Currently, partnerships have been established with the New Mexico Museum of Natural History and Science (NMMNHS), the Smithsonian Institution, the Carnegie Museum of Natural History, the Los Angeles County Museum, and the City of Las Cruces Museum of Nature and Science. The NMMNHS is the approved repository where the majority of the PTNM specimens are currently stored.

There are three types of paleontological resource use permits issued by the BLM: (1) the Survey and Limited Collection, (2) Excavation, or (3) Consulting. The BLM issues these permits under the authority of 16 USC 470aaa et seq. (*Omnibus Public Land Management Act-Paleontological Resources Preservation Act* [OPLMA-PRPA]). Prior to authorization, a research proposal must be submitted to the BLM Regional Paleontologist by a qualified paleontologist. The proposal must detail the project and describe any collection strategies. A Survey and Limited Collection permit (Reconnaissance and Survey permit) allows for limited surface collection with ground disturbance of up to 1 meter square. An Excavation permit is required for surface disturbances of over 1 meter square. An environmental evaluation under NEPA is required for all Excavation permits due to surface disturbance. A Consulting permit is normally issued to consulting paleontologists for projects that are proposed by outside proponent such as pipelines, gravel pits, or road construction. Consulting paleontologists perform pre-ground disturbing surveys for fossil resources and can monitor ground moving activities as they are happening to ensure fossil resources are protected to the greatest extent possible. The BLM can also contract with consulting paleontologists as needed.

In order to receive a paleontological resource use permit, applicants must be able to demonstrate the following (BLM Handbook 8270- *Paleontological Resource Management*):

> *(a) Professional instruction in a field of paleontology relevant to the work proposed (vertebrate, invertebrate, trace, paleobotany, etc.), obtained through:*
>
> *(1) Formal education resulting in a graduate degree from an accredited institution in paleontology, or in geology, biology, botany, zoology or anthropology if the major emphasis is in paleontology; OR*
> *(2) Equivalent paleontological training and experience including at least 24 months under the guidance of a professional paleontologist who meets qualification (1), that provided increased responsibility leading to professional duties similar to those in qualification (1) above; and*
>
> *(b) Demonstrated experience in collecting, analyzing, and reporting paleontological data*

For excavation and limited collection permits, the permittee must also identify and verify that they have an approved repository willing to curate the paleontological resources that are collected.

3.2.12 Socio-Economic Conditions

Existing social and economic conditions are necessary to establish the baseline from which to estimate potential consequences of management actions. The proceeding section analyzes the current conditions and trends related to the social and economic environment of the *Analysis Area*, including population and demographic changes, potential environmental justice populations, and local economic conditions.

3.2.12.1 Population and Demographics

This section highlights population and demographic trends in the *Analysis Area*. Population is an important consideration in managing natural resources. In particular, population structure (size, composition, density, etc.) and population dynamics (how the structure changes over time) are essential to describing the consequences of land management and planning on a social environment (Seesholtz *et al.* 2004). Population increases may lead to conflicts over land use, travel management, recreation activities, and values. These are conflicts that BLM managers attempt to balance when making management decisions.

3.2.12.1.1 Population Growth

The *Analysis Area* is home to 209,233 people (U.S. Census Bureau 2010). Table 3-5 displays U.S. Census Bureau population data for the county, state, and nation in 1990, 2000, and 2010.

Since 1990, population growth in Doña Ana County has occurred at more than double the pace of National population growth. Rapid population growth may signal expanding economic opportunities or desirable amenities. Much of southern New Mexico is occupied Federal land. Department of the Interior (DOI) and National Forest System (NFS) lands provide natural amenities, which may attract new residents to the region.

Table 3-5 Populations 1990, 2000, 2010

TABLE 3-5 POPULATIONS 1990, 2000, 2010					
LOCATIONS	POPULATIONS			PERCENTAGE (%) GROWTH	
	1990	2000	2010	1990-2000	2000-2010
Doña Ana County	135,510	174,682	209,233	29	20
New Mexico	1,515,069	1,819,046	2,059,179	20	13
United States	248,709,873	281,421,906	308,745,538	13	10
SOURCE: U.S. Census Bureau, 1990, 2000, and 2010					

3.2.12.1.2 Population Density

Population density can serve as an indicator of a number of socioeconomic factors of interest – urbanization, availability of open space, socioeconomic diversity, and civic infrastructure (Horne and Hayes 1999). More densely populated areas are generally urban and diverse, and offer better access to infrastructure. In contrast, less densely populated areas provide open space offering more natural amenity values to residents and visitors. Table 3-6 displays the number of people per square mile in the *Analysis Area*.

Despite substantial gains in population since 1990, both Doña Ana County and New Mexico continue to have low population density relative to the nation. However, Doña Ana County is several times more densely populated than the State – largely due to the presence of Las Cruces, the second-largest city in the

State, with a 2009 population of 93,680 people. Outside of Las Cruces, most of Doña Ana County is quite rural. Only 16 percent of Doña Ana County is private land. Department of Defense, Department of the Interior, Department of Agriculture, and New Mexico State lands account for over 80 percent of land ownership, which accounts for the low population density.

Table 3-6 Population Density

TABLE 3-6 POPULATION DENSITY	
AREA	**PEOPLE/SQ. MILE**
Doña Ana County	55
New Mexico	17
United States	87
SOURCE: U.S. Census Bureau 2010	

3.2.12.1.3 Median Age

Table 3-7 lists the median age in the *Analysis Area*. A high median age generally indicates that a relatively large number of retirees reside in the area. An area with a large percentage of retirees will earn income primarily from investments and transfer payments (e.g., dividends and Social Security), rather than salaries and wages. In contrast, a low median age suggests a large number of families with young children or a concentration of industries that employ large numbers of young workers.

The median age in Doña Ana County is below the State and National medians. The presence of New Mexico State University, with an enrollment of more than 20,000 students, contributes to the relatively low median age in the county (NMSU 2010).

Table 3-7 Median Age

TABLE 3-7 MEDIAN AGE	
Area	**MEDIAN AGE**
Doña Ana County	32.4
New Mexico	36.7
United States	37.2
SOURCE: U.S. Census Bureau, 2010.	

Age data may be relevant for land management decisions. A population's age may affect community values and uses associated with public land. For example, older populations may have a greater need for easily accessible recreation opportunities.

3.2.12.1.4 Educational Attainment

Educational attainment, the measure of people with at least a high school diploma or bachelor's degree, is an indicator of an area's social and economic opportunities and its ability to adapt to change. Table 3-8 lists the percentage of the adult population with at least a high school diploma and a bachelor's degree.

Table 3-8 Educational Attainment, Percent of Persons Age 25+

TABLE 3-8 EDUCATIONAL ATTAINMENT, PERCENT OF PERSONS AGE 25+		
	HIGH SCHOOL GRADUATES (%)	BACHELOR'S DEGREE OR HIGHER (%)
Doña Ana County	74.4	25.0
New Mexico	82.1	25.1
United States	84.6	27.5
Source: U.S. Census Bureau, 2009.		

Approximately three-quarters of adult residents in the *Analysis Area* are high school graduates. A quarter of study area residents have a bachelor's degree or higher. Although Doña Ana County has a lower percentage of high school graduates than either the State or Nation, the County has a similar percentage of residents with a bachelor's degree or higher. These findings suggest that the *Analysis Area* is split in terms of educational attainment – it has a relatively high proportion of individuals with low educational attainment as well as a relatively high proportion of individuals with high educational attainment (and relatively fewer individuals with moderate educational attainment). Opportunities exist for working-age adults with high levels of education. The three largest employers in Doña Ana County – Las Cruces Public Schools, New Mexico State University, and White Sands Missile Range – employ large numbers of highly skilled individuals (Peter J. Smith and Company 2009). The presence of highly educated adults may be self-reinforcing: a highly educated population is a signal that an area provides economic and cultural opportunities, which attracts additional college educated adults to the area. This process leads to further economic development and job creation. In contrast, areas with low levels of educational attainment have lower levels of human capital, which reduces an area's ability to capitalize on economic change (Florida 2002).

The presence of New Mexico State University in Las Cruces may improve the County's ability to retain and attract young residents. In areas without higher educational opportunities, young people who wish to continue their education migrate out of the area – a process known as the "*brain drain*."

3.2.12.2 Environmental Justice

Executive Order 12898 mandates that all Federal agencies analyze the potential for their actions to affect minority and low-income populations disproportionately. The Council on Environmental Quality (CEQ) suggests the following criteria for identifying potential Environmental Justice populations (CEQ 1997):

- "*Minority population: Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis…"*

- *"Low-income population: Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty. In identifying low-income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect."*

The emphasis of environmental justice is on health effects. The CEQ has interpreted health effects with a broad definition: "*Such effects may include ecological, cultural, human health, economic or social impacts on minority communities, low-income communities or Indian Tribes when those impacts are interrelated to impacts on the natural or physical environment*" (CEQ 1997).

Doña Ana County has a higher concentration of Hispanic and Latino residents than either the State or Nation. Approximately two-thirds of Doña Ana County residents self-identify as Hispanic or Latino. This finding highlights the need to analyze potential environmental justice issues in the *Analysis Area*. U.S. Census Bureau data (2010) on race and ethnicity is reported in Figure 3-11. Table 3-9 reports the percentage of residents living in poverty. Nearly one-quarter of Doña Ana County residents live in poverty.

Table 3-9 Percent of Persons Living in Poverty

TABLE 3-9 PERCENT OF PERSONS LIVING IN POVERTY	
AREA	**POVERTY RATE (%)**
Doña Ana County	24.6
New Mexico	18.1
United States	13.5
Source: U.S. Census Bureau, 2009	

The incidence of poverty in Doña Ana County is not evenly distributed among racial and ethnic groups. Approximately one-third of Hispanic residents in Doña Ana County live in poverty (U.S. Census Bureau 2000). Based on the minority status and poverty data presented above, Doña Ana County appears at risk for environmental justice issues. The largest minority group in the County – Hispanic and Latino residents – also experiences a very high poverty rate.

3.2.12.3 Employment and Income

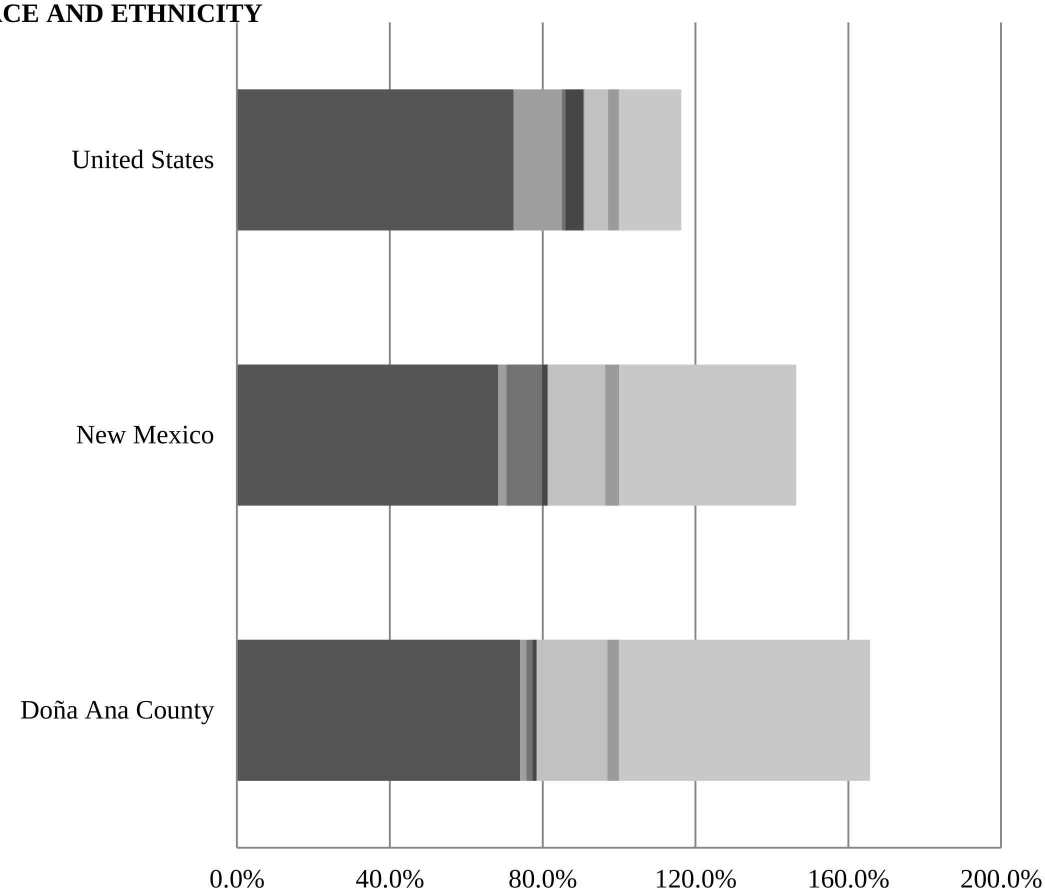
The previous section assessed demographic trends in the *Analysis Area* relative to State and National trends. This section will focus on economic conditions and trends. This discussion provides additional information on the social and economic environment in the *Analysis Area*.

3.2.12.3.1 Income and Earnings

Per capita income is a key indicator of the economic well-being of a county. High per capita income may be a signal of greater job opportunities, highly skilled residents, greater economic resiliency, and well-developed infrastructure. However, per capita income offers an incomplete picture of the economic well-being of an area. Average earnings per job provide insight into local labor market conditions. Whereas per capita income considers all sources of income (wage and salary payments, transfer payments, investment earnings, dividends, and rents), median earnings considers only wage and salary earnings. Table 3-10 provides data on per capita income and average earnings per job in 2000 and 2008 for the *Analysis Area*, State, and Nation.

Figure 3-11 Race and Ethnicity

FIGURE 3-11 RACE AND ETHNICITY



	Doña Ana County	New Mexico	United States
White	74.1%	68.4%	72.4%
Black or African American	1.7%	2.1%	12.6%
American Indian and Alaska Native	1.5%	9.4%	0.9%
Asian	1.1%	1.4%	4.8%
Native Hawaiian and Other Pacific Islander	0.1%	0.1%	0.2%
Some Other Race	18.5%	15.0%	6.2%
Two or More Races	3.0%	3.7%	2.9%
Hispanic or Latino (of any race)	65.7%	46.3%	16.3%

SOURCE: U.S. Census Bureau 2010
NOTE: Totals sum to greater than 100 percent because Hispanic and Latino individuals may be of any race.

Table 3-10 Trends in Per Capita Income and Average Earning Per Job

TABLE 3-10 TRENDS IN PER CAPITA INCOME AND AVERAGE EARNINGS PER JOB						
	PER CAPITA INCOME			AVERAGE EARNINGS PER JOB		
AREA	2000	2008	PERCENT CHANGE 2000-2008	2000	2008	PERCENT CHANGE 2000-2008
Doña Ana County	$22,633	$27,848	+23	$29,614	$33,242	+13
New Mexico	$28,446	$33,609	+18	$35,122	$38,680	+10
United States	$37,907	$40,674	+7	$43,828	$45,807	+5
SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis 2010 (http://www.bea.gov/regional/reis/action.cfm) NOTE: Figures are inflation-adjusted to 2008 US Dollars using the Bureau of Labor Statistics CPI Inflation Calculator (http://www.bls.gov/data/inflation_calculator.htm)						

Doña Ana County residents have lower per capita income and average earnings per job than other residents of the State and Nation. However, the County experienced more rapid income and earnings growth between 2000 and 2008 than either the State or Nation.

Several factors may be contributing to the relatively lower average earnings per job in the *Analysis Area*. Most job growth in Doña Ana County has occurred in retail and services employment since 1970 (U.S. Department of Commerce, Bureau of Economic Analysis 2002). Current figures indicate that health care, retail trade, and accommodation and food services are among the largest sectors (see Figure 3-12), and these jobs typically pay less than other service jobs, such as those in finance and insurance.

3.2.12.3.2 Non-Labor Income

Table 3-11 displays the role of labor and non-labor income in total personal income for 2000 and 2009. Non-labor income is any income derived from investments, dividends, rents, or transfer payments. In contrast, labor income is salary and wage disbursements from employment. During the past decade, the percentage of total income derived from non-labor sources increased in all considered areas.

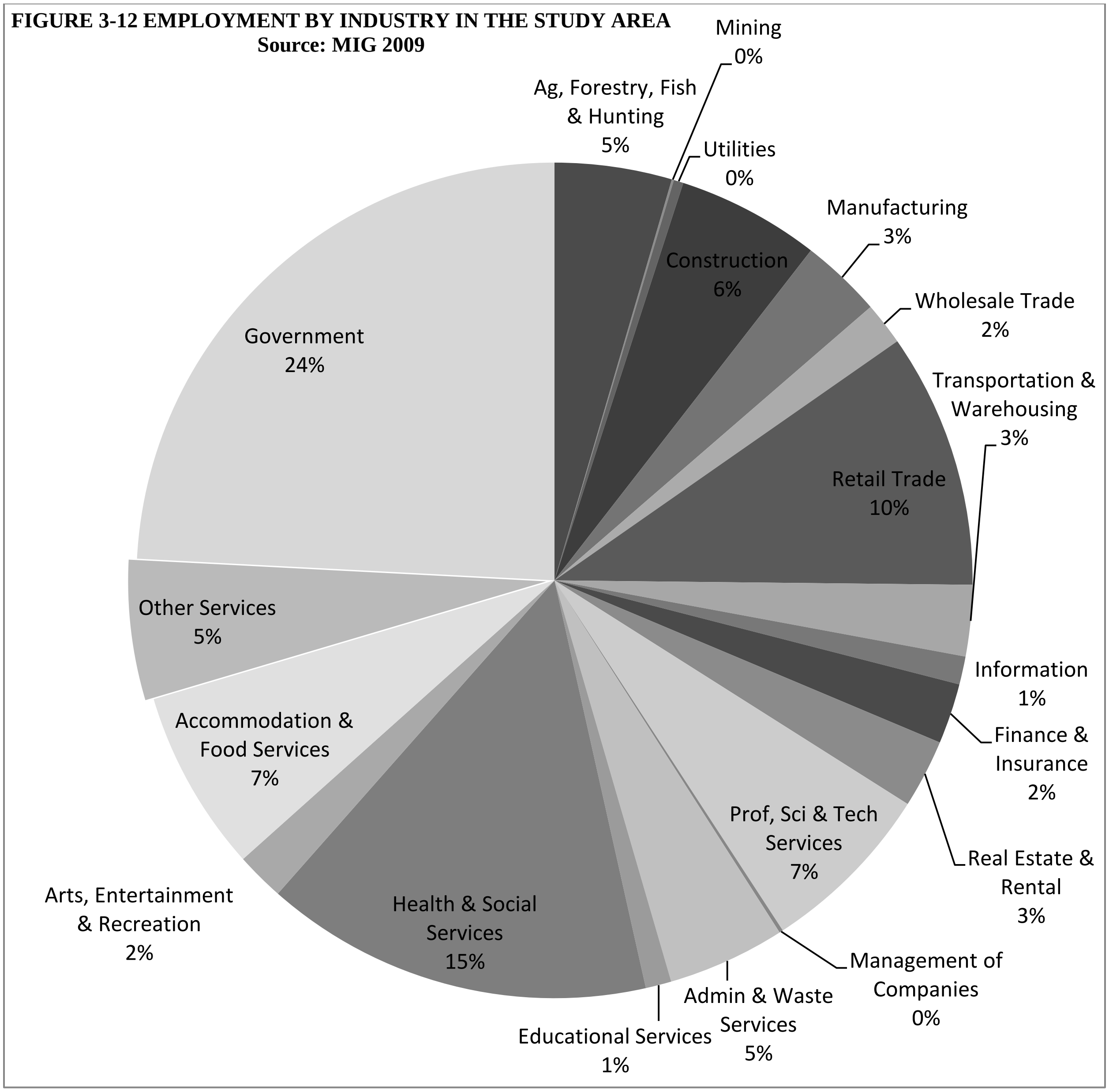
Table 3-11 Contribution of Labor and Non-Labor Income to Total Personal Income

TABLE 3-11 CONTRIBUTION OF LABOR AND NON-LABOR INCOME TO TOTAL PERSONAL INCOME				
AREA	*2000*		*2009*	
	LABOR	*NON-LABOR*	*LABOR*	*NON-LABOR*
Doña Ana County	64%	36%	61%	39%
New Mexico	66%	34%	62%	38%
United States	69%	31%	65%	35%
SOURCE: U.S. Bureau of Economic Analysis, 2011.				

Non-labor income is not directly tied to employment; therefore, it can be more resistant to economic downturns. However, as the most recent recession demonstrated, asset markets can be quite volatile, and non-labor income that depends on investment returns may be unstable.

An increase in non-labor income may reflect changing demographic characteristics. Older populations rely largely on non-labor income, including rents, dividends, and transfer payments (e.g., Social Security). High percentages of non-labor income likely indicate higher concentrations of retirees.

Figure 3-12 Employment by Industry in the Study Area



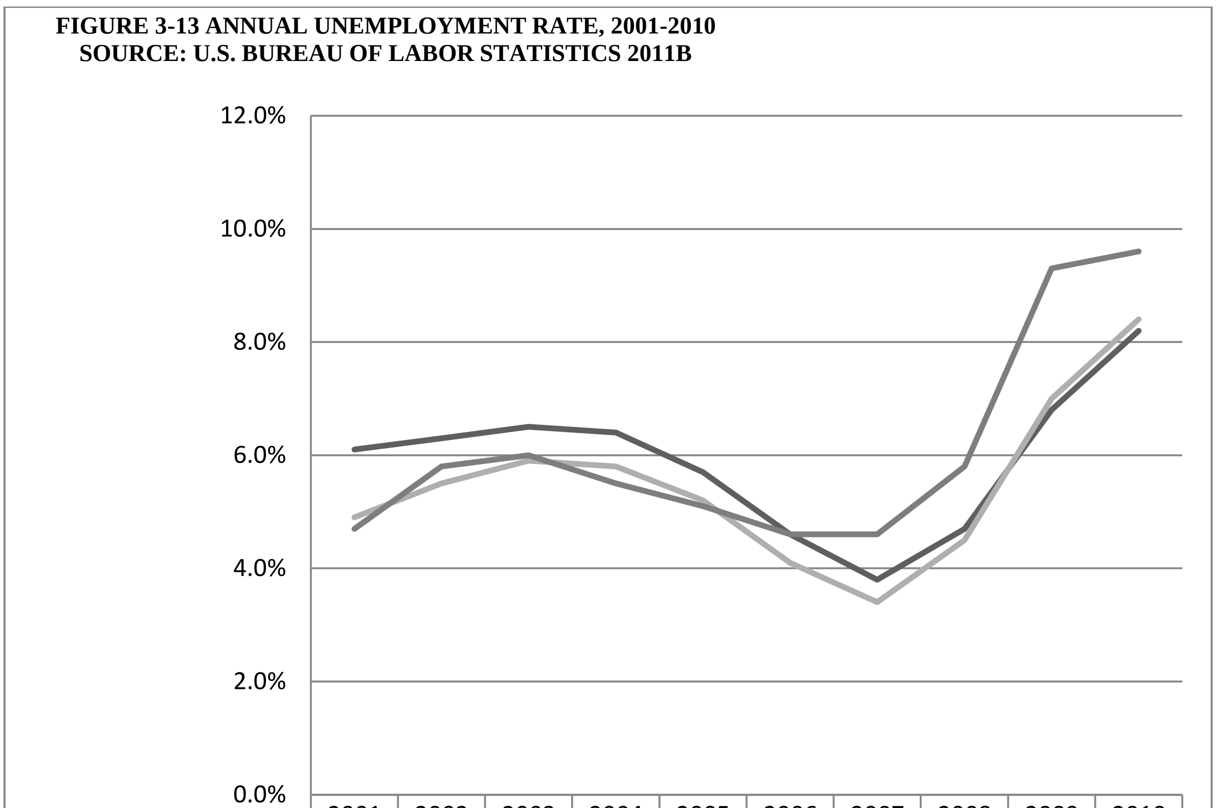
A slightly higher proportion of total personal income in Doña Ana County derives from non-labor sources compared to the State and Nation. This suggests that Doña Ana County has a somewhat higher concentration of retirees than the State and Nation.

3.2.12.3.3 Unemployment

The unemployment rate provides insight into the correspondence between residents' skills and employment opportunities. The "*natural*" rate of unemployment is said to be around 5 percent. This is the so-called "*natural*" rate because this is a level that allows for movement between jobs and industries, but does not signal broad economic distress. Recently, the National unemployment rate has hovered between 9 percent and 10 percent. Figure 3-13 provides the annual unemployment rates for counties, the State, and the Nation from 2001 to 2010.

In recent years, the unemployment rates in both Doña Ana County and New Mexico have been consistently below the National unemployment rate. This suggests that labor market conditions in the *Analysis Area* are more stable than National labor market conditions.

Figure 3-13 Annual Unemployment Rate, 2001-2010



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Doña Ana County	6.1%	6.3%	6.5%	6.4%	5.7%	4.6%	3.8%	4.7%	6.8%	8.2%
New Mexico	4.9%	5.5%	5.9%	5.8%	5.2%	4.1%	3.4%	4.5%	7.0%	8.4%
United States	4.7%	5.8%	6.0%	5.5%	5.1%	4.6%	4.6%	5.8%	9.3%	9.6%

3.2.12.4 Housing

The above comparisons of per capita income and average earnings per job between the *Analysis Area*, the State, and the Nation are incomplete. Data on local cost of living offer additional context. Of the contributions to cost of living, housing costs are among the most substantial. Table 3-12 presents median home values in 2009.

Table 3-12 Median Value of Owner-Occupied Homes

TABLE 3-12 MEDIAN VALUE OF OWNER-OCCUPIED HOMES	
AREA	***MEDIAN HOME VALUE***
Doña Ana County	$128,500
New Mexico	$150,500
United States	$185,400
SOURCE: U.S. Census Bureau 2009	

Doña Ana County has lower per capita income and average earnings per job than the State and the Nation (Table 3-10); however, the home values in the County are correspondingly lower than the State and the Nation. This finding suggests that *Analysis Area* residents spend a comparable share of their income on housing.

3.2.12.5 Economic Diversity

Economic diversity generally promotes stability and greater employment opportunities. Highly specialized economies (i.e., those that depend on very few industries for the bulk of employment and income) are prone to cyclical fluctuations and offer more limited job opportunities. Determining the degree of specialization in an economy is important for decision makers, particularly when the dominant industry can be affected by changes in policy. For the BLM, this is likely to be the case where natural resource-related industries or the tourism and recreation industries, for instance, are reliant on public land.

Figure 3-12 provides a breakdown of employment by industry in the study area. The study area economy is somewhat diverse, with a wide range of employing sectors in the local economy. Nevertheless, government employment accounts for approximately one-quarter of *Analysis Area* employment. Government, retail trade, and the health and social services sectors are the largest employment sectors in the local economy. These industries are consistent with findings discussed in the demographic section – namely a substantial government presence due to public education institutions and the White Sands Missile Range, a large retiree population that consumes health and social services, and amenities that attract tourists who contribute to the retail trade sector.

3.2.12.5.1 Payments to States and Counties

The BLM makes payments to states and counties that contain public land. Federal agencies do not pay property taxes; therefore, payments-in-lieu-of-taxes (PILT) are distributed to counties to compensate for the local services that support activities on Federal land. These services include law enforcement, road maintenance, and fire departments.

Table 3-13 lists the PILT from the PTNM and the payments attributable to all BLM-administered public land in New Mexico.

Table 3-13 Payments in Lieu of Taxes, Fiscal Year 2011

TABLE 3-13 PAYMENTS IN LIEU OF TAXES, FISCAL YEAR 2011	
	PILT
Prehistoric Trackways National Monument	$12,712
BLM New Mexico	$21,596,643
Source: DOI 2011	

3.2.12.6 Key Industries Related to BLM Management in the Analysis Area

3.2.12.6.1 Energy and Mineral Development

Mining provides 73 jobs in Doña Ana County – approximately 0.08 percent of total County employment (MIG 2009). Mining-related employment and income, therefore, play a minor role in the *Analysis Area* economy. The Monument designation withdrew the PTNM from mineral entry, which means that minerals exploration and removal are not allowed. Therefore, energy and mineral development is not discussed further as it relates to the social and economic environment.

3.2.12.6.2 Agriculture and Grazing

Agriculture, forestry, fishing, and hunting sector jobs account for approximately 5 percent total employment in the *Analysis Area*. About 258 of the 4,128 jobs in the agriculture sector relate to cattle ranching.

In 2011, Doña Ana County was home to approximately 7.5 percent of all cattle and calves in New Mexico – placing the County behind only Chaves, Curry, and Roosevelt Counties in terms of the total cattle and calf count (USDA NASS 2011).

The PTNM provides opportunities for grazing at the Picacho Peak Allotment and Altamira Ranch Allotment. The current stocking rate provides 272 AUMs to grazing permittees, although 456 AUMs are authorized. The Las Cruces District Office had 388,143 authorized AUMs in Fiscal Year 2011 (BLM 2011). Grazing on the PTNM, therefore, accounts for less than one percent of total public land grazing in the District. Public land ranchers pay a $1.35 grazing fee per AUM. Given the small amount of grazing that occurs on the PTNM, total annual grazing fees amount to approximately $615.

3.2.12.6.3 Recreation

Recreation opportunities provided on BLM-administered land provide an attraction for visitors to the *Planning Area*. Visitation to PTNM and its immediate environs is estimated at 25,000 people (10,000 party trips) annually, including use related to Special Recreation Permits (SRPs). Across BLM-administered land in New Mexico, visitation is estimated to be approximately 2.4 million people annually (BLM 2010). Recreational visitors to the *Planning Area* support employment and income in local economies. Recreation expenditures include outfitting, retail, food, and lodging services that support local economies. Visitor expenditure data specific to the PTNM are unavailable.

Recreation-related employment may be seasonal, and can be irregular. Since employment is distributed across a number of economic sectors, the precise number of recreation-related jobs in Doña Ana County is unknown, however; jobs in recreation-related sectors - retail trade, arts, entertainment and recreation, and food services and accommodation - are growing.

3.2.12.7 Non-Market Values

Public land has both market and non-market values. Market values include commodity uses of public land resources, such as timber or minerals. Market values are relatively easy to measure. The economic impact of marketed goods and services are captured in the economic input-output analysis. Non-market values, however, are more difficult to assess. Non-market values may arise from direct use of the resources (e.g., hunting for personal use and subsistence gathering) or from passive use (sometimes called non-use). Passive use captures the value of knowing that the resource(s) exist, whether or not future direct use is intended. Public land provides numerous values that are often of direct use to humans, even if they are not recognized. Clean water, climate regulation, and the research and educational opportunities that unique ecosystems afford are a few of the many ecosystem goods and services whose values are not addressed in traditional economic impact analysis.

3.2.13 Soils

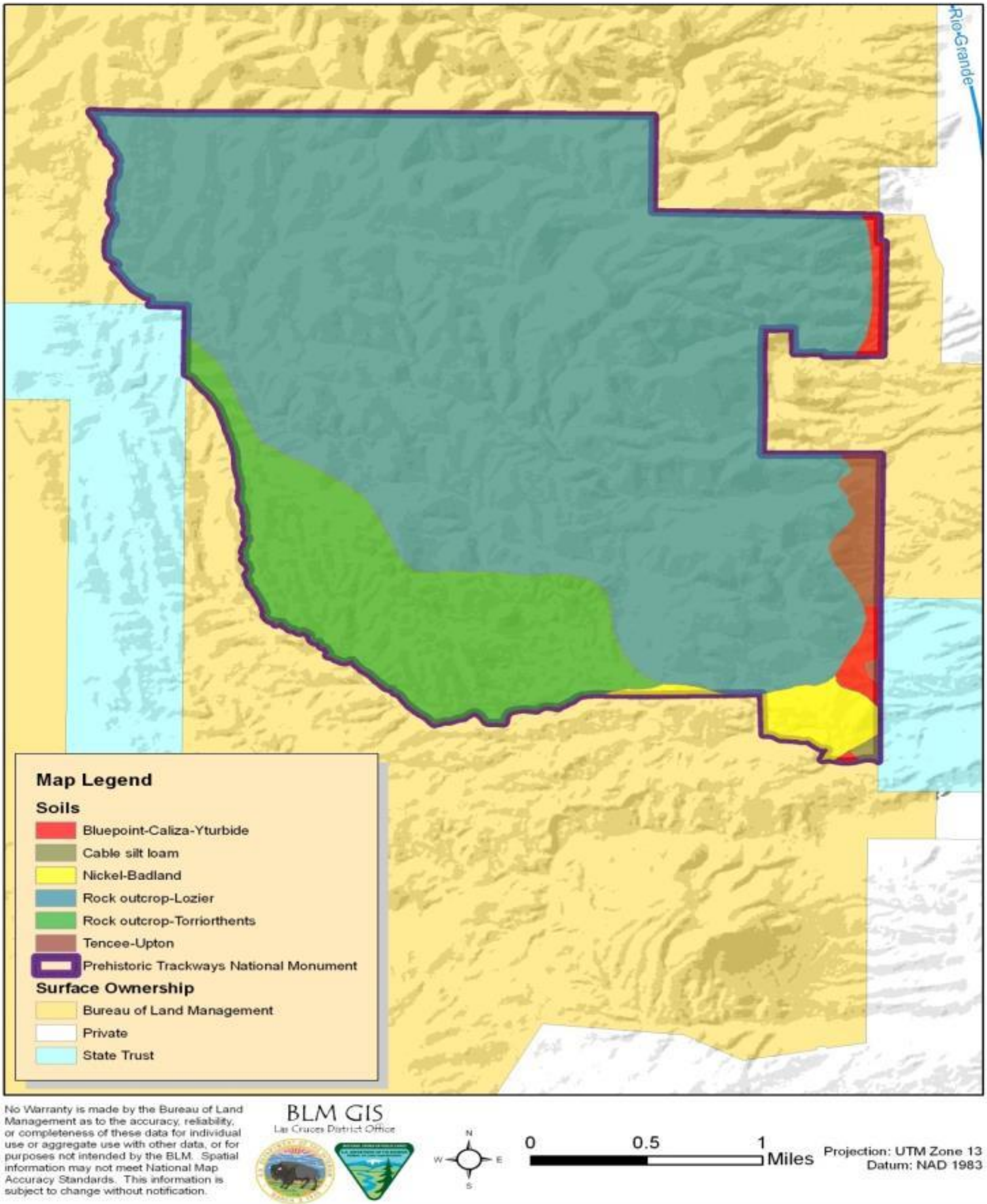
The soil resources of the Monument are categorized according to soil associations or in the recent terminology of the Natural Resource Conservation Service (NRCS) surveys, general soil map units. Soils in the Monument are primarily the product of climate, geologic parent material, landscape, and time.

Soils in the Monument are semiarid, young, and poorly developed. Physical, chemical, and biological soil development processes, such as rock weathering, decomposition of plant materials, accumulation of organic matter, and nutrient cycling proceed slowly in this environment. Likewise, soil recovery processes from soil disturbances are slow and can lead to long-term changes in ecology and productivity. The most extensive soil degradation and erosion occurs in the very southern portion of the Monument where erosion of gypsiferous sandstones and mudstones on steeper slopes form a "*badlands*" type of topography. While localized anthropogenic caused erosion is present, the erosional features present are typical when these rock and soil types are exposed to weathering.

Five separate soil classifications exist within the Monument boundaries (see Map 3-4). The most dominant soil type is the Rock outcrop-Lozier association. These soils extend the entire length of the Monument from north to south and cover 4,180 acres (79 percent) primarily in the central and northern portions of the Monument. These soils are typically very shallow stony loam with high rock fragment content up to cobble size, overlying bedrock on steep slopes and tops of ridges. Soils on steeper slopes have a higher potential for water erosion. Where rock content and vegetation is locally decreased, some soil movement is apparent by occasional soil lines on rock fragments and pedestalled plant bases usually less than 2 inches in height. However, the large percentage of bedrock outcrops (approximately 45 percent) and high rock fragment content is adequate at slowing water flow velocities, hindering wind erosion, and stabilizing the shallow soils over most of the area. Drainage bottoms are generally composed of large cobbles, boulders, and bedrock with very little soil, soil accumulation, and soil production potential due to channelized high water flows.

The Rock outcrop-Torriorthents association is located in the southwestern portion of the Monument and covers approximately 860 acres (16 percent) within the Monument. These soils are shallow to moderately deep gravelly loam and gravelly sandy loam, found on hills and hill slopes with moderate to steep gradient and contain approximately 40 percent rock outcrop. Where rock content is locally decreased, these soils can be susceptible to moderate amounts of soil loss from water erosion and surface disturbance and to a lesser amount wind erosion. The Torriorthents soils in the Monument may occasionally have short discontinuous rills, soil lines on rock fragments, localized weak gravel lag, and a few short pedestaled plant bases. Where large percentages of bedrock outcrops and high rock fragment are present, the rock content in these soils is generally adequate at slowing water flow velocities, hindering wind erosion, and stabilizing the soils over most of the area.

Map 3-4 - Soils


Rio Grande
Map Legend
Soils
Bluepoint-Caliza-Yturbide
Cable silt loam
Nickel-Badland
Rock outcrop-Lozier
Rock outcrop-Torriorthents
Tencee-Upton
Prehistoric Trackways National Monument
Surface Ownership
Bureau of Land Management
Private
State Trust
No Warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by the BLM. Spatial information may not meet National Map Accuracy Standards. This information is subject to change without notification.
BLM GIS
Las Cruces District Office
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Projection: UTM Zone 13
Datum: NAD 1983

Nickel-Badland complex soils forming on alluvial fans and escarpments are present in the southeastern portion of the Monument and cover approximately 100 acres (2 percent). Typically, very gravelly sandy loam, interbeds of fine silt and clay may be present in the soil profile. High surface gravel content often forms a weak gravel lag, which hinders soil movement. Soil surface erosion rates are generally low for these soils, but may vary with changes in particle size, gravel abundance, and slope gradient. However, underlying stratigraphic beds of poorly cemented gypsiferous sandstones and mudstones tend to weather more easily, creating a "*badlands*" type of topography.

Comprising approximately 3 percent of the Monument is the Bluepoint-Caliza-Yturbide complex (60 acres) and Tencee-Upton association (80 acres) soils formed on alluvial fans along the eastern flank of the Robledo Mountains. Slope gradients range from 5-15 percent in the loamy sand of the Bluepoint, 15-40 percent in the Caliza gravelly sandy loam, and 1-8 percent for the gravelly loamy sand in the Yturbide soils. Slopes for the Tencee-Upton association range from 3-15 percent in gravelly sandy loam and a petrocalcic layer may be present between 7-20 inches in the subsurface. Wind and water erosion is approximated from moderate to high in the Bluepoint soils and low to moderate for the Tencee-Upton soils, respectively.

Areas in which the topography is primarily controlled by underlying rock and relatively resistant to erosion such as the Rock outcrop-Lozier and Rock outcrop-Torriorthents association soils, soil loss could result from decreased vegetation and water infiltration as well as increased surface water runoff. However, with resistant bedrock shallow in the profile, dramatic changes in topography and channel form, as well as excessive erosion such as rills and gullies, would not be expected. For deeper soils, finer grained soils, and soils that have formed on poorly consolidated and poorly cemented sedimentary layers, such as the remaining four soil types in the Monument, the effects of soil loss is greater. Soils with these characteristics are more susceptible to erosion and impacts from surface disturbances and experience higher erosion rates, accelerated down-cutting, changes in topography, increased sedimentation downstream, and drainage degradation and alteration.

3.2.14 Special Designations

3.2.14.1 Area of Critical Environmental Concern

The Robledo Mountains ACEC consists of 8,695 acres, which includes much of the Robledo Mountains WSA and part of the Monument. The Robledo Mountains ACEC was evaluated for Relevance and Importance in the *Mimbres RMP* and meets the relevance criteria of having significant paleontological, cultural, and scenic values and endangered plant species. It meets the importance criteria of more than locally significant resources in terms of scenic quality, which is enjoyed by hundreds of thousands of travelers on I-25 annually, and for preservation of biodiversity, which is distinctive (*Mimbres RMP*, page 5-43). The Robledo Mountains support a high diversity of cacti including Scheer's pincushion cactus and night-blooming cereus. They also provide important habitat for uncommon reptiles such as the Madrean alligator lizard and Trans-Pecos rat snake. The Monument encompasses 789 acres of the ACEC (same area as the WSA in the Monument). See Map 3-5. Planned management actions in the *Mimbres RMP* (BLM 1993) for the ACEC that apply to the land within the Monument are:

- Retain all public land
- Limit vehicle use to designated roads and trails
- Exclude authorization for new rights-of-way
- Close to mineral material sales and to fluid mineral leasing
- Acquire legal public access
- Maintain current livestock grazing practices

- Allow natural fires to burn under prescribed conditions
- Manage for primitive and semi-primitive recreation opportunities (no developed facilities)
- Manage as VRM Class I
- Manage for recreation opportunity spectrum (ROS) primitive and semi-primitive non-motorized and semi-primitive motorized classes

3.2.14.2 Research Natural Area

The Paleozoic Trackways Research Natural Area (RNA) designation was established in the *Mimbres RMP* (BLM 1993). It establishes 720 acres on the southeast portion of the Robledo Mountains as the RNA (see Map 3-6). It was designated in order to protect, research, and interpret paleontological values. Within the 720 acres, footprints and trackways of vertebrate and invertebrate animals from Permian Age are preserved in the rock. The potential for this site to produce scientific information and specimens is considered high. Planned management actions are as follows:

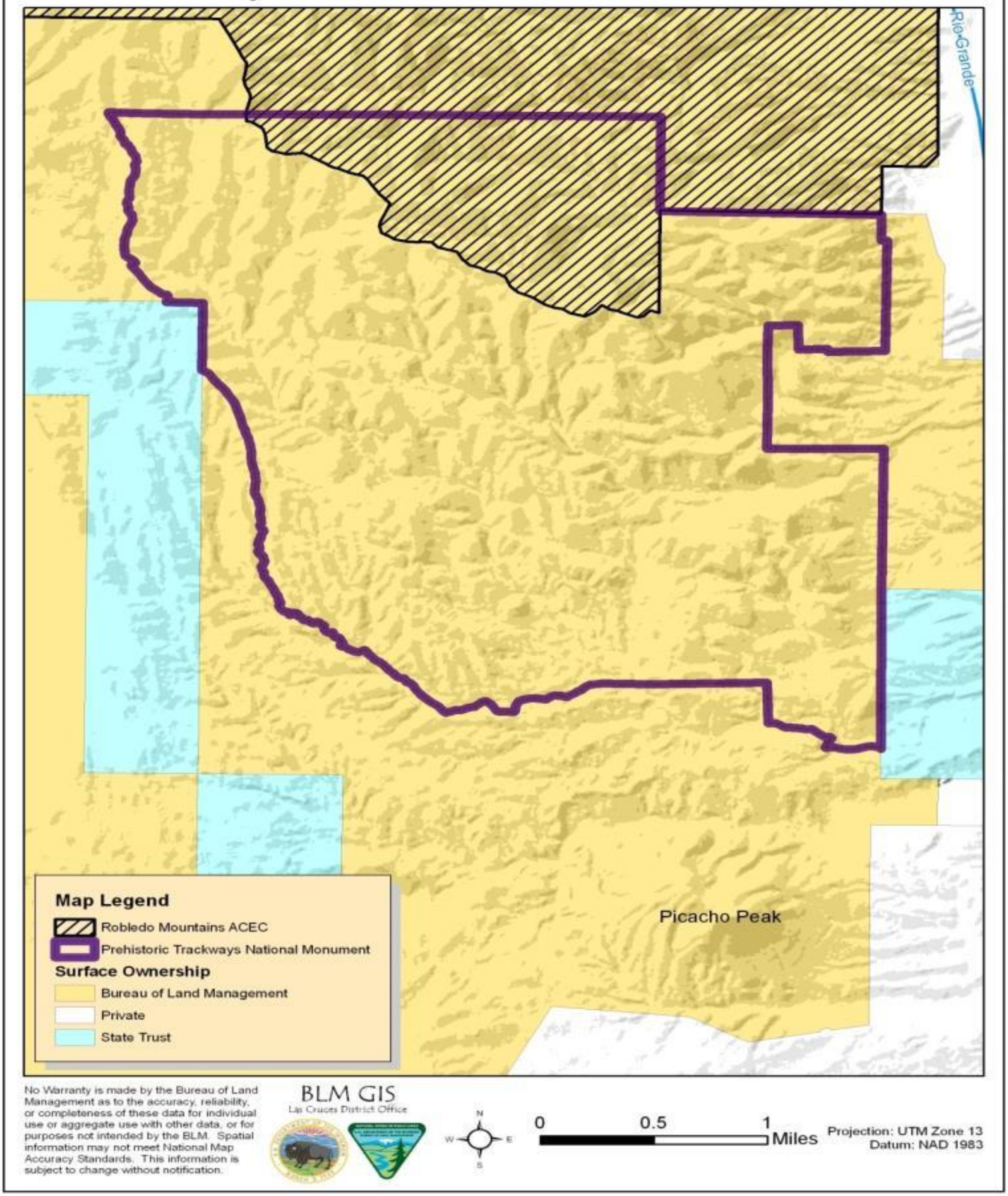
- Retain all public land
- Limit vehicle use to designated routes
- Exclude new ROWs
- Withdraw from locatable mineral entry
- Close to mineral material sales
- Close to fluid mineral leasing
- Acquire legal public access
- Manage according to recommendations in the Trackways Study Legislation (Lucas et al. 1994)
- Manage as VRM Class II
- Manage for ROS semi-primitive, non-motorized class

3.2.14.3 Wilderness Study Area

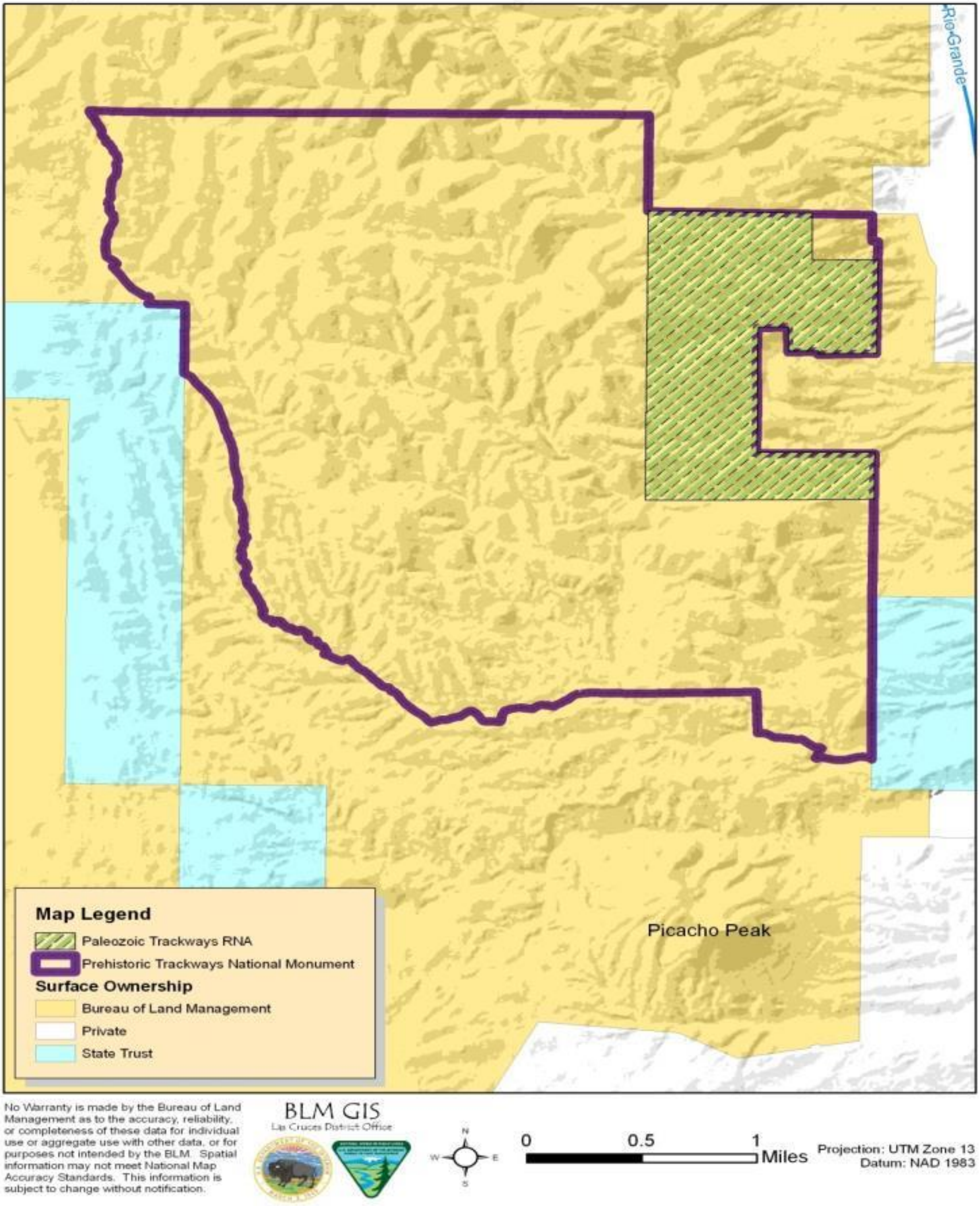
Designated in 1980, the Robledo Mountains WSA consists of 13,033 acres. The southern tip of the WSA, approximately 789 acres, extends into the Monument (see Map 3-7). This area has been managed according to *BLM Handbook 8550-01: Interim Management Policy and Guidelines for Lands under Wilderness Review* so the suitability of such an area for preservation as wilderness would not be impaired until designated wilderness or released by Congress.

In the mid-90s, the BLM discovered that unauthorized OHV use was occurring which was degrading the values of the fossil resources. This use was curtailed and directed south, outside of the WSA. As a result, the scars created by the use are slowly healing.

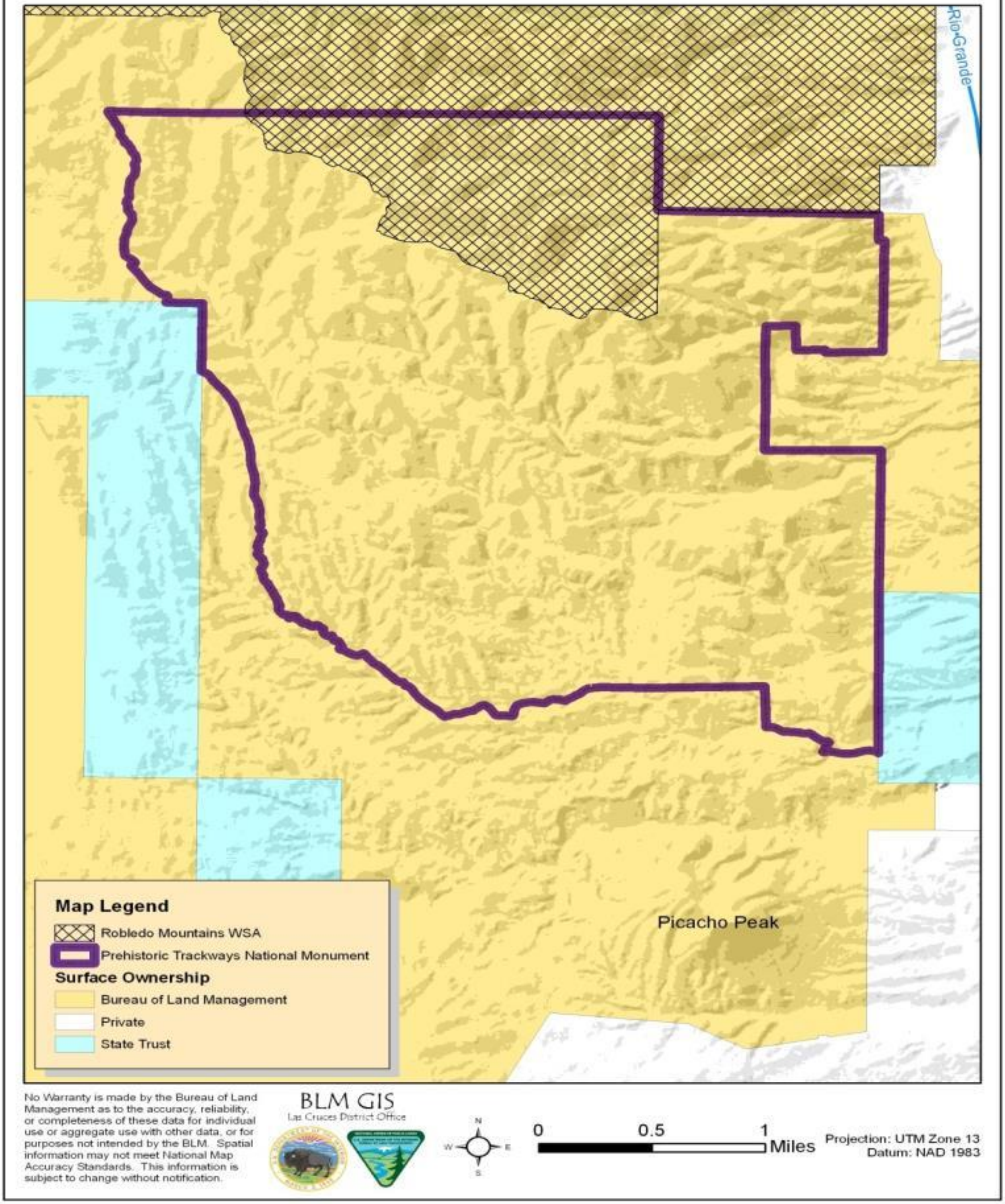
Map 3-5 - Robledo Mountains ACEC



Map 3-6 - Paleozoic Trackways Research Natural Area



Map 3-7 - Robledo Mountains WSA



3.2.15 Special Status Species

BLM special status species are: (1) species listed or proposed for listing under the Endangered Species Act (ESA), and (2) species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA, which are designated as BLM sensitive by the BLM State Director. The Robledo Mountains contain habitat that is associated with several species of animals and one plant species that are considered special status. These species have been identified in accordance with procedures set forth in *BLM Manual 6840: Special Status Species Management*. All Federal candidate species, proposed species, and delisted species in the 5 years following delisting will be conserved as BLM sensitive species. The presence of special status plant species and their habitats in the *Planning Area* were considered using Las Cruces District species occurrence/habitat records and New Mexico Natural Heritage Program species records. Species descriptions and distributions were derived from Las Cruces District office records and New Mexico Rare Plant Technical Council [NMRPTC 1999: New Mexico Rare Plants. Albuquerque, NM: New Mexico Rare Plants Home Page. http://nmrareplants.unm.edu (Latest update: 11 July 2011)]. Table 3-14 lists the special status species that may potentially be associated with habitat located in the Robledo Mountains.

Although BLM does not have a record of specific occurrences and locations of any special status species within PTNM, suitable habitat does occur throughout the Monument for each special status species.

Table 3-14 Special Status Species

TABLE 3-14 SPECIAL STATUS SPECIES		
COMMON NAME	**SCIENTIFIC NAME**	**STATUS***
Texas horned lizard	*Phryonsoma cornutum*	BLMS
Burrowing owl	*Athene cunicularia hypugaea*	BLMS, FWSS
Loggerhead shrike	*Lanius ludovicianus*	BLMS
Cave myotis bat	*Myotis velifer*	BLMS
Long-legged myotis bat	*Myotis volans interior*	BLMS
Fringed myotis bat	*Myotis thysanodes thysanodes*	BLMS
Spotted bat	*Euderma maculatum*	BLMS
Pale Townsend’s big-eared bat	*Corynorhinus townsendii pallescens*	BLMS, FWSS
Night-blooming cereus	*Peniocereus greggii var greggii*	BLMS, FWSS
NOTE: * CONSERVATION STATUS: FWSS=USFWS Species of Concern, BLMS=BLM SENSITIVE		

Habitat descriptions for the special status species that have habitat in the Robledo Mountains are as follows:

Texas horned lizard (*Phrynosoma cornutum*). This species is ubiquitous over southern New Mexico, occurring in a variety of open desert grassland and shrubland habitats. They are common in a range of seral communities. There is insufficient population trends data on this species in the Robledo Mountains.

Burrowing owl (*Athene cunicularia hypugaea*). Burrowing owls are year-round residents of southern New Mexico. Preferred habitat includes open shrubland and grassland. These owls occur in a variety of seral communities ranging from disturbed areas to climax grassland and are tolerant of human activity. They occur in desert scrub dominated by mesquite, yucca and cactus. They use abandoned prairie dog, ground squirrel, fox, badger and similar burrows as well as ground holes in road cuts for nesting. Population trends for the Robledo Mountains are not known.

Loggerhead shrike (*Lanius ludovicianus*). Loggerhead shrikes are a year-round resident of southern New Mexico in open shrub and grasslands. Riparian habitat is an essential environmental component. Nest habitat includes small trees and shrubs. Population trends for the Robledo Mountains are not known.

Cave myotis (*Myotis velifer*). Both subspecies occur in southern New Mexico. These bats are migratory over much of their range, but occur in southern New Mexico year-round. They occur in arid habitats, preferring desert floodplains and rocky canyon lands. Dense arroyo and riparian vegetation may be important foraging habitat. This species hibernate in caves and roost primarily in caves and mines forming large colonies. Population trends for the Robledo Mountains are not known.

Long-legged myotis (*Myotis volans*). The subspecies for New Mexico is *M. v. interior*. This species is most common in coniferous forest, but is known from high grassland and woodland habitats. They use mines and caves as hibernacula and night roosts. Cracks and crevices in rocks, buildings, tunnels, hollow trees and loose tree bark are utilized for day roosts. Summer nursery colonies form in tree hollows, rock crevices, and buildings. Population trends for the Robledo Mountains are not known.

Fringed myotis (*Myotis thysanodes*). The subspecies in New Mexico is *M. t. thysanodes*. This summer resident myotis occurs over most of the western two-thirds of New Mexico, most commonly in grasslands and oak-piñon woodlands. It is also known to occur from desert scrub to coniferous forest. They forage close to the vegetation canopy for moths and beetles primarily, but do take other insects. Maternity and day roost habitat includes rock crevices, caves, mines, snags and buildings. Population trends for the Robledo Mountains are not known.

Spotted bat (*Euderma maculatum*). Spotted bats are year-round residents, ranging widely in New Mexico, but are very rare in occurrence. They are found in a variety of habitats from low desert to conifer forest. Spotted bats forage in habitats such as forests, woodlands, riparian/riverine, as well as, old fields. The most important habitat component is rock and cliff features. They are strongly associated with broken canyon terrain and cliff habitat where day roosts are normally located, most in association with or near open water. Spotted bats are thought to be a non-colony forming species. Population trends for the Robledo Mountains are not known.

Big free-tailed bat (*Nyctinomops macrotis*). This uncommon yet wide-ranging bat occurs in arid, rocky habitats of New Mexico. They have been known to occur in desert shrub, woodlands and as high as evergreen forests near 2.5 km in elevation. They are believed to be seasonal migrants, though it is thought that some may hibernate in southern New Mexico. These bats roost and form maternity colonies in cracks and crevices of rock outcrops and cliff faces. There is insufficient data to determine population trends of this species in the Robledo Mountains.

Pale Townsend's big-eared bat (*Corynorhinus townsendii pallescens*). The Pale or western Townsend's big-eared bat occurs year-round in most areas of New Mexico. They inhabit a variety of vegetation habitats with proximity to rocky, broken expanses as a likely prerequisite. Caves and mines are crucial habitat components and may contain high concentrations of bats during hibernation and while rearing young. This species is highly intolerant of roost site disturbance, which can result in roost abandonment and substantial mortality. Population trends for the Robledo Mountains are not known.

There are no known special status species that are specific to the Robledo Mountains nor are the standard habitat sites which occur in the Robledo Mountains habitat obligates for any special status species.

Night-blooming cereus (*Peniocereus greggii* var. *greggii*), which is considered a species of concern by the U.S. Fish and Wildlife Service, a sensitive species by the BLM, and endangered by the State of New

Mexico, may also occur here, but it is widespread in southern New Mexico though not abundant at any location. Night-blooming cereus is usually associated with creosotebush and honey mesquite both that occur in and around the Robledo Mountains. Night-blooming cereus occurs mostly in sandy to silty gravelly soils in the Chihuahuan Desert, shrubland and desert grassland. Night-blooming cereus grows up through and is supported by shrubs like creosotebush and honey mesquite.

3.2.16 Vegetation

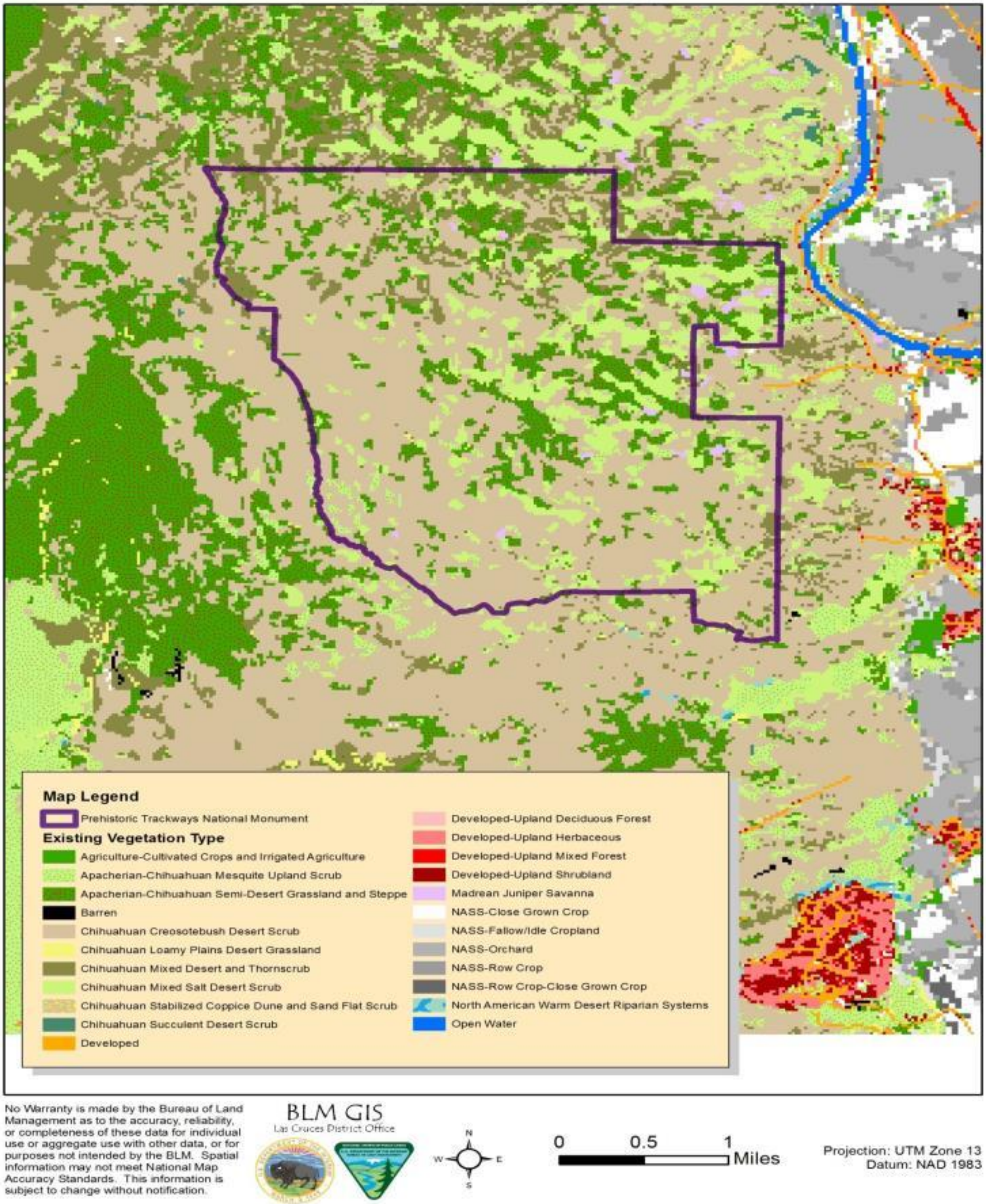
The National Vegetation Classification (NVC) was developed to standardize information about vegetation in the United States. This classification helps align vegetation data collection across different agencies and vegetation management programs, helping provide a greater understanding of vegetation communities.

The dominant vegetation type found within the Monument is Apacherian-Chihuahuan Semi-Desert Grassland and Steppe. Within this vegetation type, five ecological systems are present within the Monument. The dominant system in the PTNM is Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub. The other main ecological systems are Chihuahuan Mixed Salt Desert Scrub, Chihuahuan Mixed Desert and Thorn Scrub, Apacherian-Chihuahuan Semi-Desert Grassland and Steppe, and Apacherian-Chihuahuan Mesquite Upland Scrubland (See Map 3-8).

The plant species found in the Monument are characteristic of these vegetation types, and plant communities found within the Chihuahuan Desert in general. Common grass species within the Monument include: black grama (*Bouteloua eriopoda*), blue grama (*Bouteloua gracilis*), sideoats grama (*Bouteloua curtipendula*), bush muhly (*Muhlenbergia porteri*), threeawn grasses (*Aristida spp.*), tobosa (*Pluraphis mutica*), Arizona cotton top (*Digitaria californica*), cane bluestem (*Bothriochloa barbinodis*), slim tridens (*Tridens muticus*), mesa dropseed (*Sporobolus flexuosus*), sand dropseed (*Sporobolus cryptandrus*), fluffgrass (*Dasyochloa pulchella*), plains bristlegrass (*Setaria leucopila*), six-weeks grama (*Bouteloua barbata*), and burrograss (*Scleropogon brevifolius*). Common shrubs and trees include agave (*Agave spp*.), sotol (*Dasylirion spp.*), ocotillo (*Fouquieria splendens*), feather peabush (*Dalea formosa),* broom snakeweed (*Gutierrezia sarothrae*), yucca (*Yucca spp.*), creosotebush (*Larrea tridentata*), longleaf ephedra (*Ephedra trifurca*), mariola (*Parthenium incanum*), Apacheplume (*Fallugia paradoxa*), range ratany (*Krameria parvifolia*), broom dalea (*Psorothamnus scoparius*), tarbush *(Flourensia cernua)* , littleleaf sumac (*Rhus microphylla*), white thorn (*Acacia constricta.*), prickly pear (*Opuntia spp.*), barrel cactus (*Ferocactus wislizenii*), hedgehog cactus (*Echinocereus spp.*), mesquite (*Prosopis glandulosa*), juniper (*Juniperus monosperma),* skunkbush (*Rhus aromatica*), and shrub live-oak (*Quercus turbinella).* Forbs found in the area commonly are wooly plantain (*Plantago patagonica*), globemallow (*Sphaeralcea spp*.), wild buckwheat (*Eriogonum spp.),*California bricklebush (*Brickellia californica),* tansey mustard (*Descurainia pinnata*), Russian thistle (*Salsola kali*), desert holly (*Perezia nana)*, woolly paperflower (*Psilostrophe tagetina*), croton (*Croton spp.*), scorpion weed (*Phacelia spp.)*, blanket flower (*Gallardia pinnatafida),* bladder pod (*Lesquerella spp.),* filaree (*Erodium cicutarium*), and spectacle pod (*Dimorphocarpa wislizenii)*. Vegetation along the ephemeral drainages includes desert willow (*Chilopsis linearis),* littleleaf sumac, and cutleaf bricklebush (*Brickellia laciniata).*

Determinations of rangeland health and condition, and vegetation management decisions utilize information found in ecological site descriptions that have been developed and are maintained by the Natural Resources Conservation Service (NRCS). The NRCS identifies large geographically associated land resource units called major land resource areas (MLRAs), which delineate areas with common topography, geology, climate, water resources, soils, biological resources including plant, fish, and wildlife species, and common land uses. The *Planning Area* is within the Southern Desert Basins, Plains and Mountains MLRA number 42, land resource unit SD-2. Elevations within MLRA-42 range from 2,600 to 5,000 feet in basins and valleys, and more than 7,800 feet in the tallest mountains. Broad desert

Map 3-8 - Vegetation



basins and valleys are bordered by gently sloping to strongly sloping fans and terraces. Steep north-south trending mountain ranges and many small mesas occur in the MLRA. Average annual precipitation ranges from 8-14 inches. Most precipitation occurs from mid-spring to mid-autumn. Average annual temperature is between 55-65° F. An average freeze-free period from 200 to 240 days occurs in most of the area.

MLRAs are divided into distinct ecological sites, which more specifically describe climate, soils, and expected vegetation on a more localized scale. More information on MLRAs and ecological site descriptions can be found at http://efotg.sc.egov.usda.gov/treemenuFS.aspx . Ecological site descriptions describe in detail the historic climax vegetation that is expected on a particular site, and contain state and transition models which discuss different plant community phases and the mechanisms by which plant communities can shift from one state to another through disturbances or restoration activities.

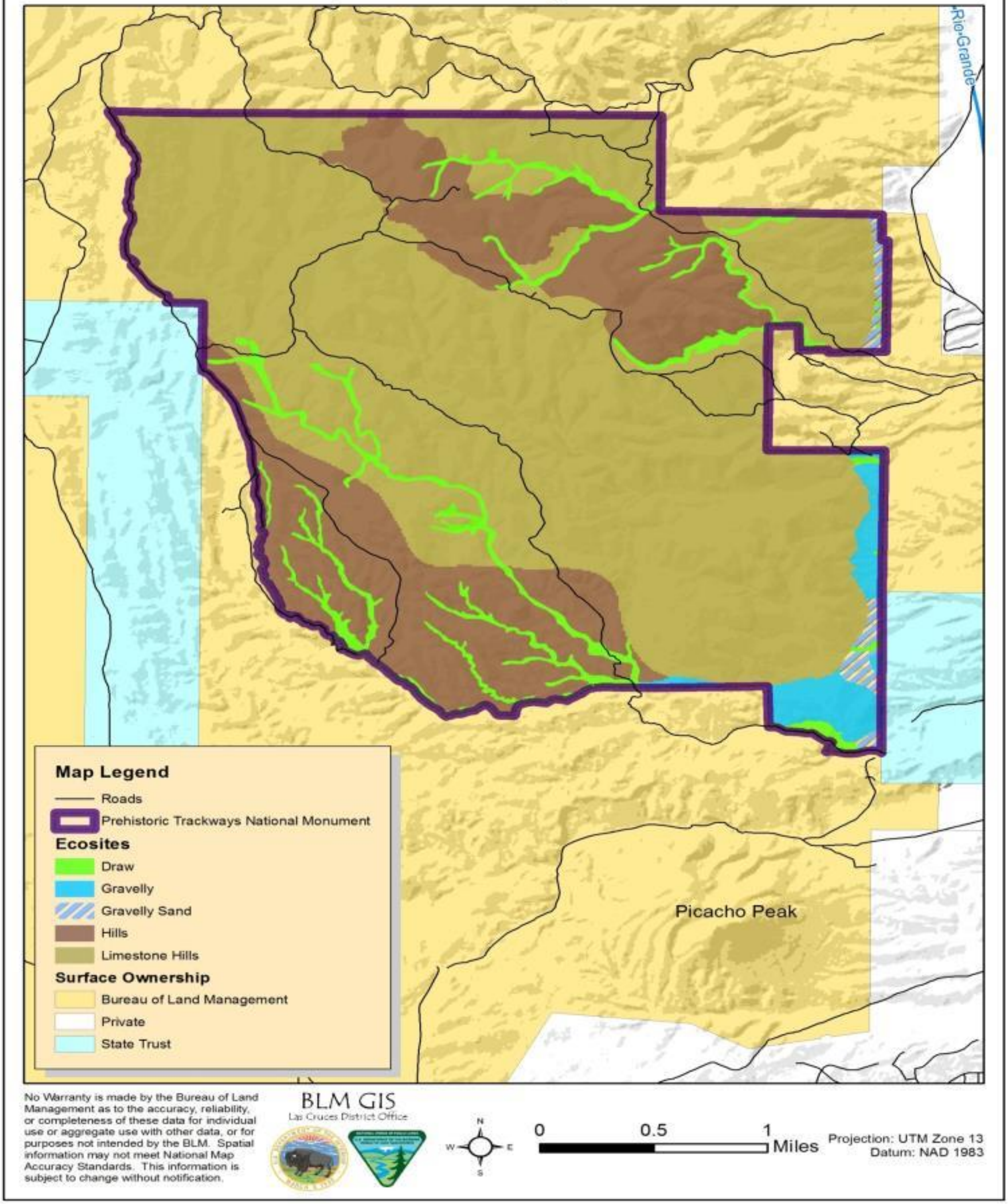
Generally speaking, vegetation communities within the Monument exist in a stable state. Minor shifts within the current state are generally attributable to precipitation patterns. Based on recent observations, ongoing drought conditions have limited plant vigor and productivity throughout much of the Monument during dry years; however, adequate monsoonal rains help plant communities rebound during wetter years. The majority of the Robledo Mountains consists of limestone hills, while the gravelly sites occur mainly on the southern and the eastern edge of the mountain range. Public land in the PTNM are primarily within the hills and limestone hills ecological sites with only a small portion of the area (south and east part of the PTNM) located in gravelly and gravelly sand ecological sites. See Map 3-9. Ephemeral drainages cross through portions of the Monument, and were classified as belonging to the draw ecological site based on recent mapping of ecological sites; however these drainages do not resemble the typical draw ecological site. Theses drainages are predominately seasonal arroyos dominated by upland vegetation, which occasionally run large amounts of water for brief durations during intense thunderstorms characteristic of the monsoon in the desert Southwest. The limestone hills ecological sites within the Monument are in a grassland/succulent state. The hills ecological sites within the Monument also generally occur in a grassland/succulent state with a fair amount of invasion by creosotebush evident. The gravelly and gravelly sand ecological sites within the Monument occur in a shrub-dominated state where creosotebush is dominant on the landscape with an understory present consisting of grama grasses, bush muhly, and fluff grass.

The changes made to grazing management on the Picacho Peak Allotment over time have resulted in improvement to rangeland condition from mid-poor to low-fair on limestone hills sites and from mid-fair to low-good on gravelly sites according to data obtained during the revision of the allotment management plan in 1997.

3.2.16.1 Noxious Weeds or Invasive Species

A noxious weed is defined as *a plant species designated by federal or state law as generally possessing one or more of the following characteristics: aggressive, and difficult to manage; parasitic; a carrier or host of serious insects or diseases, or non-native, new, or not common in the United States* (USDI 2007). Invasive plants include not only noxious weeds, but also other plants that are not native to the ecosystem into which they have been introduced, and exhibit characteristics that give them a competitive advantage over the desirable native species, often causing economic or environmental harm. As a result, they usually have no natural enemies to limit their reproduction and spread (Masters and Sheley 2001; Westbrooks 1998). The establishment and spread of invasive species can directly affect vegetation by

Map 3-9 - Ecological Sites



increasing the overall competition with native species for limited resources including water and nutrients. Over time, invasive species also can alter the structural and functional components of an ecosystem, i.e., soil structure/function, hydrologic function, fire return intervals, and energy flow (DiTomaso 2000) severely enough that reestablishment of native or desirable species is not feasible (Masters and Sheley 2001). Common locations for noxious or invasive weed infestations include roadsides, recreation areas frequented by hikers, mountain bikers, ATVs/UTVs, and four-wheel drive vehicles, livestock concentration areas, recreational dumping spots and areas that are highly disturbed or degraded from miscellaneous land uses.

Noxious weeds in New Mexico have been classified based on their relative distribution within the State and the management strategies by which these weeds should be managed. New Mexico State University has published a guide book containing additional information on New Mexico's noxious weed species of concern, their distribution, identification and strategies for management (Jamshid et. al. 2010). Classes of New Mexico's listed noxious weeds are described below:

- **Class A weeds -** Weeds that are not native to an ecosystem and have a limited distribution within the State are placed in this class. Preventing new infestations and eliminating infestations have the highest priorities in the management plan. Species not presently found in the State but threatening to invade are placed in this class.

- **Class B weeds -** Weeds that are not native to the ecosystem and are presently limited to a particular area of the State are listed within this class. The management priority is to contain them within their current areas. Preventing infestations in new areas also has a high priority.

- **Class C weeds -** Weeds that are not native to the ecosystem yet are widespread throughout the State. Long-term programs of management and suppression are encouraged.

There are no known populations of Class A or Class B noxious weeds that have been identified within the Monument as a result of weed surveys. Class C weeds present within and nearby the Monument are individual plants and isolated populations of saltcedar (*Tamarix rammosissima*). Saltcedar is a deciduous or evergreen shrub or small tree that typically grows from 5 to 20 feet tall. "Saltcedar was introduced from Eurasia and is now widespread in the United States" Whitson (*et al.* 2006). The Tamarisk family, which includes saltcedar, has been used as ornamentals and has also been cultivated for use in erosion control and windbreaks (Vallentine 1989), but this plant has proliferated and has "become naturalized along streams, canals, and reservoirs in much of the west" (Whitson *et al.* 2006). Stands form monocultures, which limit native plant and wildlife biodiversity. Large plants of saltcedar can transpire at least 200 gallons of water per plant each day (Whitson *et al.* 2006). Saltcedar has been found to have low water use efficiencies and exhibit salt tolerance (Glenn *et al.* 1998), and actually tends to increase soil salinity through salts excreted from the leaves (Smith *et al.* 1998; Ladenburger *et al.* 2006), which would give them a competitive advantage over less tolerant native plants. Saltcedar within the Monument is primarily located within Apache Canyon. This noxious weed tends to grow where water troughs may be leaking onto the ground, where manmade earthen reservoirs or flood control dams have been constructed, or where moist soils may exist at some point in the year just long enough to support individual plants. No other riparian obligate plant species persist near this saltcedar, and no other habitat that is conducive to a riparian area exists at these sites. The areas where saltcedar may be found on the Monument are not considered riparian areas and would not be managed as such. Isolated individuals and smaller populations can also be found in smaller ephemeral side drainages on Federal, State trust and private lands adjacent to the Monument.

Common weed species occur within and around the PTNM. Some of the more common weeds encountered include Russian thistle, silverleaf nightshade (*Solanum elaeagnifolium* Cav.), various pigweeds species (Amaranthus spp.), puncturevine (*Tribulus terrestris* L.), spotted and prostrate spurge (*Chamaesyce maculate* L.), and common cocklebur (*Xanthium strumarium* L.). These common weeds are typically found in disturbed areas and near livestock watering points. Cocklebur tends to occur mainly along drainages and in earthen reservoirs.

3.2.16.2 Rangeland Health and Standards for Livestock Grazing

The grazing regulations (43 CFR 4180.1) require that the authorized officer ensure that the following four conditions for rangeland health exist on the grazing allotments:

- Ecological processes are to be maintained, or there is to be significant progress toward attainment of these processes, that would support a healthy biotic community.
- Habitats are, or are to be making significant progress toward, being maintained or restored for Federal threatened and endangered, proposed threatened, Federal candidate, Federal species of concern or other species with special status.
- Water quality complies with the water quality standards of the State, and is to achieve, or to make significant progress toward achieving, any management objectives established by the BLM.
- Watersheds are to be in, or to be making significant progress toward achieving a properly functioning condition.

In January 2001, the BLM completed a Statewide Resource Management Plan Amendment and Environmental Impact Statement in which three Public Land Health Standards were adopted to address uplands, biotic communities, and riparian areas. The authorized officer would make a determination for each public land health standard as follows:

- Is the standard being met?
- If the standard is not being met, is livestock a causal factor?
- Does existing management conform to the Guidelines for Livestock Grazing Management?

Historic monitoring studies on the Picacho Peak Allotment were completed between 1983 and 1995. During that time period, gravelly ecological sites improved from fair to good condition, and the limestone hills ecological site improved from poor to fair condition as a result of changes in grazing management. The Picacho Peak Allotment is managed under an allotment management plan, which was updated and amended in 1997. Monitoring data collected in 1982 indicated that the Altamira Ranch Allotment was also in fair to good condition.

In 2010, Range Health Assessments were conducted on the public land within the Prehistoric Trackways National Monument by an interdisciplinary team of specialists with expertise in rangeland, soils, hydrology, and wildlife resources. Assessments were conducted at two sites within the limestone hills ecological site, and one site was evaluated in the hills ecological site within the Monument. One gravelly ecological site was evaluated outside of the Monument boundary; however, this site was within a quarter of a mile from the Monument, and was considered to be representative of gravelly sites in the *Planning Area*.

Twenty-one public land health indicators were used to assess soil and site stability, hydrologic function, and biotic integrity in accordance with methodology described in Interpreting *Indicators of Rangeland Health, Version 4, Technical Reference 1734-6* (Pellant *et al*., 2005). The indicators were evaluated according to departure from the reference conditions based on expected historical climax communities and on ecological site descriptions maintained by the Natural Resources Conservation Service. Rangeland health assessment worksheets are on file at the Las Cruces District Office.

Determination/Rationale

1. **Standard 1 (Upland Sites)**

   Upland ecological sites are in productive and sustainable condition within the capability of their sites. Upland soils are stabilized and exhibit infiltration and permeability rates that are appropriate for the soil type, climate, and landform. The kind, amount, and/or pattern of vegetation provide protection on a given site to minimize erosion and assist in meeting state water quality standards.

   Determination: It has been determined that Standard 1 (Upland Sites) is not currently being met, but current livestock management practices are not significant factors. Grazing management on the allotments within the Monument conforms to the Guidelines for Livestock Grazing Management.

   Rationale: Standard 1 (Upland Sites) was analyzed using 10 indicators relating to soil stability. These indicators include rills, water flow patterns, pedestals and/or terracettes, bare ground, gullies, wind-scoured, blowouts, and/or deposition areas, litter movement, soil surface resistance to erosion, soil surface loss or degradation, and compaction layer.

   Overall, soils matched the reference condition across all sites for several of the indicators, including water flow patterns, gullies, wind-scoured blowouts and/or deposition areas, litter movement, and compaction layer. The hills ecological site had the greatest degree of departure from reference condition, and as such, influenced the determination for not meeting the Upland Site standard. The hills site had a moderate degree of departure for rills, pedestals, and soil surface loss or degradation. The hills site had a slight to moderate departure from reference condition with regard to bare ground and soil surface resistance to erosion. While the preponderance of evidence indicates that, overall, the hills site is only slightly to moderately departed from the reference, the indicators show that soil erosion has occurred and soils could continue to be susceptible to losses in the future.

   Generally speaking, the gravelly ecological site closely matched reference; however, the soil surface loss or degradation indicator showed a moderate degree of departure from the reference condition expected for the site. Thus, it is likely that there has been some historic soil loss that has occurred on this site, but the remaining indicators suggest that soils are currently stable due to a high degree of rock cover that helps protect the soil.

   The limestone hills ecological sites were in the best condition overall, with all soil stability indicators matching reference at one site. The other limestone hills site had a few pedestals present, mainly on individual tarbush shrubs and there was some soil loss evident.

   In consideration of the data obtained from rangeland health assessments, there has been some soil erosion that has occurred on the Monument. While many areas are not experiencing active erosion, susceptibility to erosion varies throughout the Monument. One of the main contributing factors to not meeting the standard for upland sites is directly related to vegetation communities present on the Monument. Some areas have good vegetation cover and diversity or high amounts of rock that help protect the soil from erosion. Other areas, especially where shrub encroachment by creosotebush is more pronounced, continue to be susceptible to accelerated soil erosion.

2. Standard 2 (Biotic Communities) Including Native, Threatened, Endangered, and Special Status Species

Ecological processes such as the hydrologic cycle, nutrient cycle, and energy flow support productive and diverse native biotic communities, including special status, threatened, and endangered species appropriate to the site.

Determination: It has been determined that Standard 2 (Biotic Communities) is not currently being met, but current livestock management practices are not significant factors. Grazing management on the allotments within the Monument conforms to the Guidelines for Livestock Grazing Management.

Rationale: Standard 2 was analyzed using 11 indicators relating to hydrology and 13 indicators that describe biotic integrity. These indicators include rills, water flow patterns, pedestals and/or terracettes, bare ground, gullies, soil surface resistance to erosion, soil surface loss or degradation, plant community composition and distribution relative to infiltration and runoff, compaction layer, functional structural groups, plant mortality and decadence, litter amount, annual production, invasive plants, reproductive capability of perennial plants, wildlife habitat, wildlife populations, special status species habitat, and special status species populations.

Hydrologic function indicators matched the reference across all sites for water flow patterns, gullies, and compaction layer. As with soils, the hills site had the greatest degree of departure from reference, and was rated as having a moderate change overall. Indicators rated as moderately departed from reference were rills, pedestals and/or terracettes, soil surface loss or degradation, plant community composition and distribution relative to infiltration, and the amount of litter present. There was a slight to moderate departure for bare ground and soil surface resistance to erosion. For the gravelly site, most of the indicators closely matched reference, except for litter amount, soil surface loss or degradation, and plant community composition and distribution relative to infiltration. The hydrologic function at one of the limestone hills sites very closely matched the reference condition, while the other site showed a slight departure from reference with regard to pedestals, soil surface loss, plant community composition and litter.

Biotic integrity indicators closely matched the reference across all sites for compaction layer, wildlife habitat, wildlife populations, special status species habitat, and special status species populations. Biotic integrity was rated as moderately departed from the reference on both the hills and gravelly sites. The indicators that were most influential in causing this shift were soil surface loss or degradation, functional structural groups, annual production and invasive plants. For the hills site, there was a also a moderate departure from reference conditions with regard to litter amount, but only a slight departure was observed for soil surface resistance to erosion. For the gravelly site, the indicators for litter and reproductive capability of perennial plants were slightly departed from the reference. Consistent with the other indicator groupings, biotic integrity within the limestone hills ecological site closely matched reference at one site, while the other site was rated as having a slight to moderate departure from the reference condition. The main factors contributing to the shifts on limestone hills sites were changes to functional structural groups and litter amount, and to a lesser degree soil surface loss, plant mortality and decadence, annual production, and invasive plants at one of the sites.

When considering these groupings of rangeland health indicators, the major factor contributing to not meeting the standard for biotic communities is directly related to the plant community present across much of the Monument. The main cause for any departure from the standards was the increase of creosotebush density, which was observed at high enough levels to consider this to be an invader of hills and limestone hills ecological sites within the Monument. While creosotebush is native to the hot desert regions of the southwest, including the Chihuahuan desert, this shrub can increase to the point where it becomes out of balance with the desired plant community composition. Increasing densities of creosotebush often lead to increased competition with grasses and forbs for limiting water and nutrients. Currently, plant communities within the Monument are in a stable state, which would require active vegetation treatments in order to shift communities back toward a more productive grassland state. Some areas have the potential to respond favorably to treatment with the presence of a good perennial grass understory, but the area is characterized by rugged topography, which would preclude herbicide treatments in many areas due to concerns of herbicide drift on slopes steeper than 10 percent.

3. **Standard 3 (Riparian Sites)**

   Riparian areas are in a productive, properly functioning, and sustainable condition, within the capability of that site.

   There are no riparian sites within the PTNM, thus this standard is not applicable to the *Planning Area*. Several ephemeral drainages and canyons cut through the Monument; however they do not support riparian obligate vegetation thus they are not considered to be riparian areas.

3.2.17 Visual and Scenic Resources

The PTNM is a very expressive example of the Chihuahuan Desert with its variety of native plant and animal species along with the rugged terrain captured in the Robledo Mountains. A high diversity of cacti provide habitat for many reptiles within the Monument. During the spring and monsoon seasons, flowers abound on the desert plants and cacti. Thousands of residents and travelers on Interstate 25 and Interstate 10 view the Robledo Mountains every day. The adjacent closed Community Pit #1 is a major visual impact and landscape modification. Areas showing major impacts to the line, form, color and texture are clearly evident even from several miles away. These impacts in Community Pit #1 include areas of vegetation removal, roads, rock piles and landings for stockpiling and loading the excavated rock.

Visual resources include natural and manmade physical features that give landscapes scenic quality and provide scenic views. Visual resources are interrelated with social and economic values, beliefs, and attitudes, lifestyle, quality of life, well-being, and place-based values, which all influence a viewer's perception of the scenic quality and importance of scenic resources.

The BLM uses a systematic approach of visual resource inventory (VRI) to measure visual resource values. The results of this inventory provide the basis for considering visual values in the RMP process and assigning visual resource management objectives.

There are three components of a VRI Classification process:

1. ***Scenic Quality Evaluation*** – This is a measurement of the visual appeal of a landscape and is based on seven key factors: landform, vegetation, water, color, influence of adjacent scenery, scarcity, and cultural modification. The Scenic Quality Rating of the Robledo Mountains is *"Class B"*, which indicates a *Medium* rating based on observed characteristics such as highly eroded features with good color and mountain views, sparse vegetation, and cultural modification (the Community Pit quarry site).

2. ***The Sensitivity Level Analysis*** – This is a measure of public concern for scenic quality. The Robledo Mountains overall rating of *High* is based on a combination of public sensitivity for the WSA, the ACEC, and the PTNM. The Monument is rated *High* for its level of public interest and amount of recreational use.
3. ***Delineation of Distance Zones*** - Viewsheds across public land are divided into three distance zones based on relative visibility from various travel routes or observation points, they are: (1) the foreground-middleground zone which occurs at 3-5 miles, (2) the background zone which occurs 5 miles and beyond, and (3) the seldom seen zone which occurs in those areas not otherwise visible from commonly travel routes or observation points. The entire PTNM was inventoried within the Foreground/Middleground Distance Zone.

As indicated in the *Mimbres RMP* (1993), the Monument is designated into all four VRM Classes (See Map 3-10). Table 3-15 displays the total acreage of public land within the Monument per VRM Class.

Table 3-15 Visual Resource Management Acreages within the PTNM

TABLE 3-15 VISUAL RESOURCE MANAGEMENT ACREAGES WITHIN THE PTNM	
VRM CLASS	**ACRES**
Class I	789
Class II	907
Class III	2,627
Class IV	932
TOTAL	5,255
SOURCE: *Mimbres* RMP, 1993.	

With the VRI (defined above) serving as a baseline to quantify visual values, the BLM then considers other RMP decisions and resource allocations that may affect these values to arrive at appropriate visual resource management objectives. These objectives, or classes, are divided into four categories:

1. <u>Class I Objective</u> - to preserve the existing character of the landscape. This class provides for natural ecological changes but does not preclude very limited management activity.

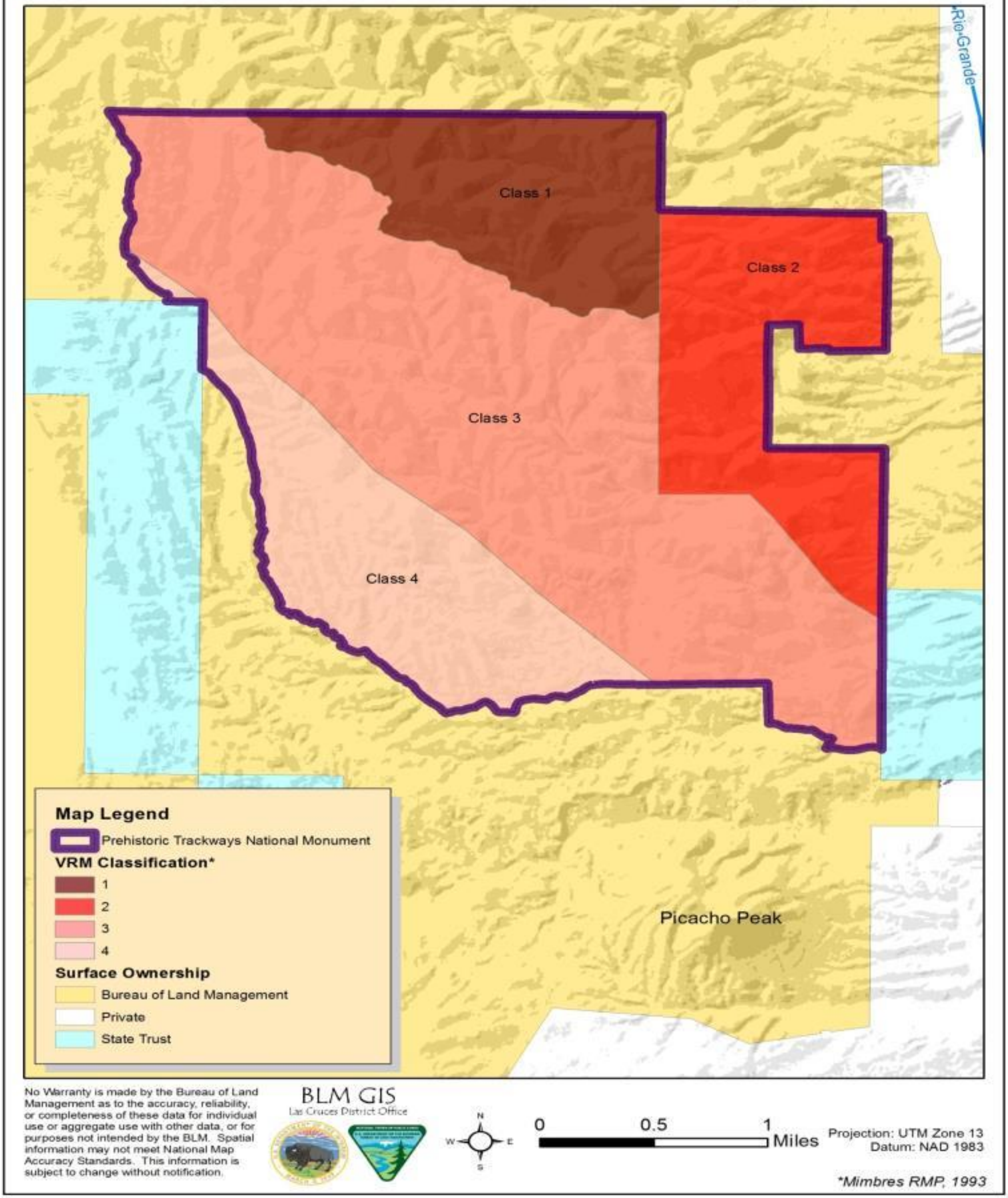
2. <u>Class II Objective</u> - to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer.

3. <u>Class III Objective</u> - to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer.

4. <u>Class IV Objective</u> - to provide for management activities, which require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high.

Based on the components of VRI identified above and management considerations for other land uses, public land is placed into one of four VRI classes. These inventory classes represent the relative value of the visual resources. Classes I and II being the most valued, Class III representing a moderate value, and Class IV being of least value. Based upon the most recent VRI of the *Planning Area* that was undertaken in 2009, the entire PTNM *Planning Area* was rated as a VRI Class II.

Map 3-10 - Visual Resource Management



3.2.18 Water Resources

3.2.18.1 Groundwater

All water rights in New Mexico are acquired in accordance with the State's substantive and procedural law, except where Congress or the Executive Branch has created a Federal reservation with a reserved water right.

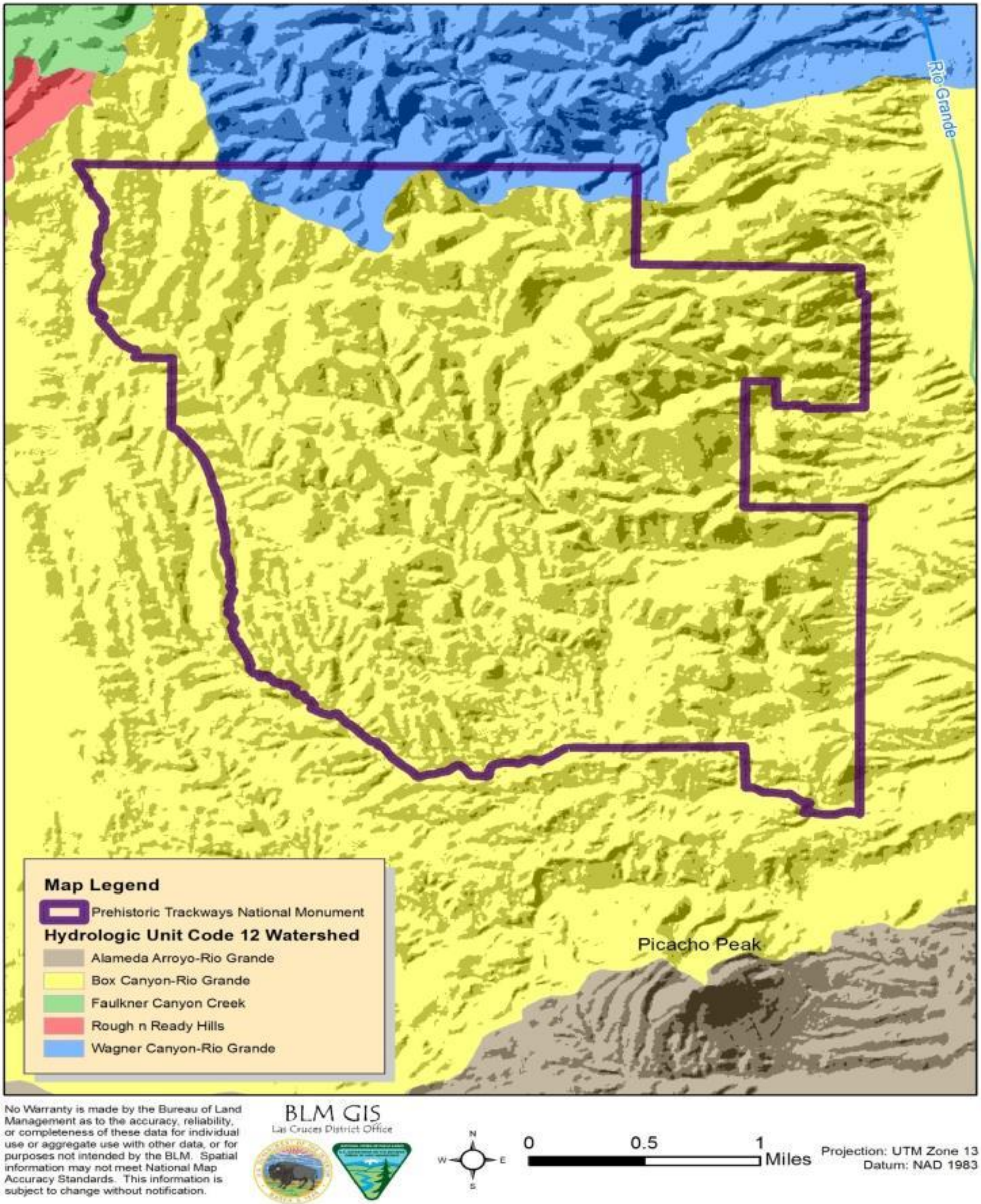
The New Mexico Office of the State Engineer (NMOSE), as designated by statute and judicial decision, has divided the State into declared groundwater basins to assess and adjudicate water resources. The Monument and surrounding area lie within the Mesilla Basin, which is a sub-basin of the Lower Rio Grande Basin. According to NMOSE records, depths to the water table can vary widely throughout the Mesilla Basin. Variations can be from a few tens of feet along the Rio Grande to over 1,000 feet at various locations within the Valley. There are no records of wells or groundwater monitoring sites known to be present within the Monument boundaries.

The Santa Fe Group (Oligocene-Pleistocene) forms the major aquifer in this region and consists of a thick sequences of alluvial, fluvial, aeolian, and lacustrine sediments deposited in the intermountain basins of the Rio Grande Rift valley. Although the Santa Fe Group is present along the eastern boundary of the Monument, it comprises a very small percentage of the geologic formations located within the Monument. This equates to a very small percentage of the Monument containing prime aquifer characteristics. Some beds such as sandstones, conglomerates, or dissolved limestone beds within the Hueco Group, may contain water storage capabilities; however, these beds are relatively thin and can be laterally discontinuous. Additionally, tectonic uplift, volcanism, and intrusive events related to continental rifting have resulted in a structurally complex mountain range. Given the geologic history from deposition, deformation, and alteration of the Hueco Group in the Robledo Mountains, it is unlikely that any significant groundwater or potential aquifers exist in the Hueco Group within the Monument. Should small quantities of groundwater be present in selective beds of the Hueco Group, it would not be expected to have a significant nexus to groundwater in the Mesilla Basin aquifer. Given the history of the Robledo Mountains, the inferred lack of aquifer potential, and the absence of groundwater data within the Monument, there is a high degree of uncertainty regarding groundwater throughout the Monument.

3.2.18.2 Surface Water

There are no perennial surface waters located within the Monument. Surface water is limited to ephemeral and intermittent overland and in-channel flows during rainfall events. Water flows within arroyos primarily flow southeast and east and terminate at the Rio Grande (See Map 3-11). This water is both seasonally common and an essential component of the public land. Desert washes primarily function as areas of overland flow collection and recharge areas for the surrounding watershed. Ephemeral pools, either in-channel or in the uplands, are watering sites for wildlife and livestock.

Map 3-11 Watersheds



Water quality analysis in New Mexico is designed to satisfy the statutory requirements of Section 303(d), the reporting requirements of Sections 305(b) and 314 of the Federal Water Pollution Control Act [33 U.S.C. 1251 *et seq.*], commonly known as the Clean Water Act. The New Mexico Environment Department (NMED) Surface Water Quality Bureau's *2010-2012 State of New Mexico Clean Water Act 303(d)/305(b) Integrated List and Report* found that the Rio Grande, from the International Mexico Boundary to 1 mile below Percha Dam, exceeds the allowable concentrations of *Escherichia coli* (*E. coli*). Additionally, the report lists probable sources for *E. coli* as avian sources (e.g., waterfowl), concentrated animal feeding operations, impervious surfaces/parking lot runoff, municipal point source discharges, on-site treatment systems (e.g., septic systems), rangeland grazing, wastes from pets, and wildlife. Even though the Rio Grande is located adjacent to and not within the Monument boundary, watersheds within the Monument drain into the Rio Grande. This provides the BLM with the responsibility to mitigate any action that may contribute contaminants into the Rio Grande and to protect the State's water resources. Contaminants not only include *E. coli* that may further degrade water quality, but rather any contaminants that may lead to an additional impairment(s) of water quality.

Ongoing studies to identify *E. coli* concentrations and its sources are being conducted along the Rio Grande within the Lower Rio Grande Watershed. Key partners for these studies include the NMED Surface Water Quality Bureau, Elephant Butte Irrigation District, and Dr. Phil King and Dr. Geoff Smith with New Mexico State University. Results of *E. coli* studies revealed high levels in the Rio Grande during fall rainstorms and high levels in the lower portion of the watershed. Birds were the most abundant source identified followed by livestock, wildlife, pets and sewage, and *E.*coli concentrations were higher downstream of Picacho Bridge (Smith 2012). The Lower Rio Grande Watershed encompasses the Rio Grande Basin from Percha Dam (south of Caballo Reservoir, approximately 70 miles north of Las Cruces, New Mexico), downstream to the Texas-Mexico boundary adjacent to the cities of El Paso, Texas and Ciudad Juarez, Mexico, (approximately 30 miles south of Las Cruces) and comprises approximately 1.5 million acres. This stretch is in the U.S. Geologic Survey (USGS) Hydrologic Unit Code (HUC 13030102) located in Sierra and Doña Ana counties. The Monument comprises approximately 0.3 percent of the Lower Rio Grande Watershed. While it is likely that non-point source pollutants such as *E. coli* are transported to the Rio Grande from the Monument during large storm events, it is inferred that the small size of the Monument watershed does not contribute a significant quantity of pollutants when compared to other sources located outside of the Monument.

The *Planning Area* receives approximately 9 inches of rainfall annually. Most of this occurs in July and August in the form of thunderstorms. Localized heavy rainfall often results in flash flooding in the arroyos carrying large quantities of sediment and debris.

3.2.19 Wildland Fire Management

The existing vegetation within the Monument is not conducive to carrying a fire. As stated earlier in the Vegetation section, the combination of the existing soils and climate lead to a desert grass-shrub vegetation community. The sparse understory does not lend itself to large wildland fires. Historically, there has not been any known wildland fire event within the *Planning Area*.

A natural fire regime is the pattern, frequency, and intensity of the wildfires that prevails across a landscape without the intervention of humans. A fire regime condition class (FRCC) is a classification of the amount of departure from the natural fire regime (see Table 3-16). Historical fire regimes provide a baseline against the current condition of an area and the effects of the change to the ecosystem. Fire is a natural part of a healthy ecosystem and the FRCC helps land managers plan the response to wildfires across the landscape (see Map 3-12). Fire Management Plans (FMPs) develop management responses to wildfire for all Fire Management Units (FMU).

Map 3-12 - Fire Regime Condition Classes

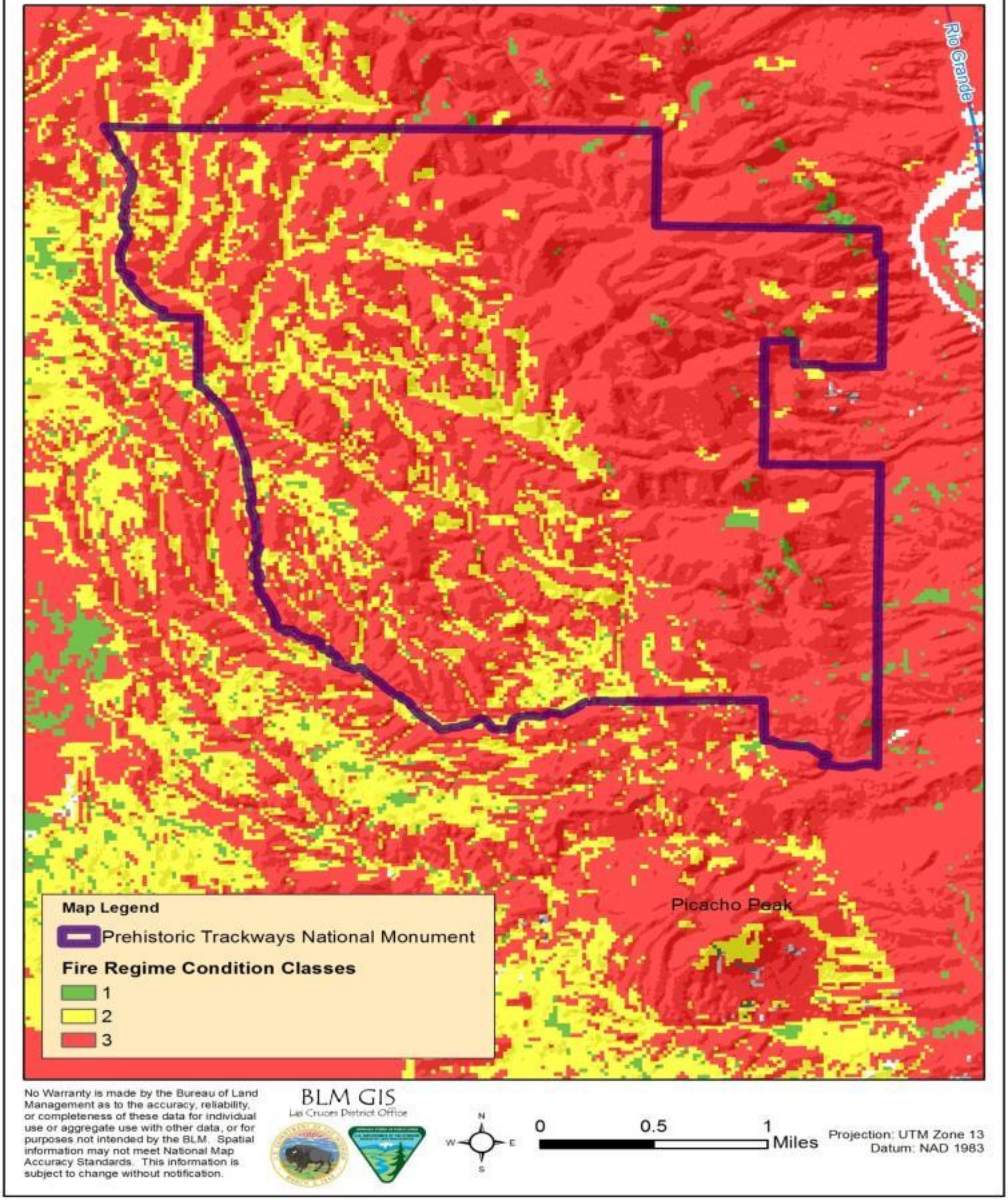
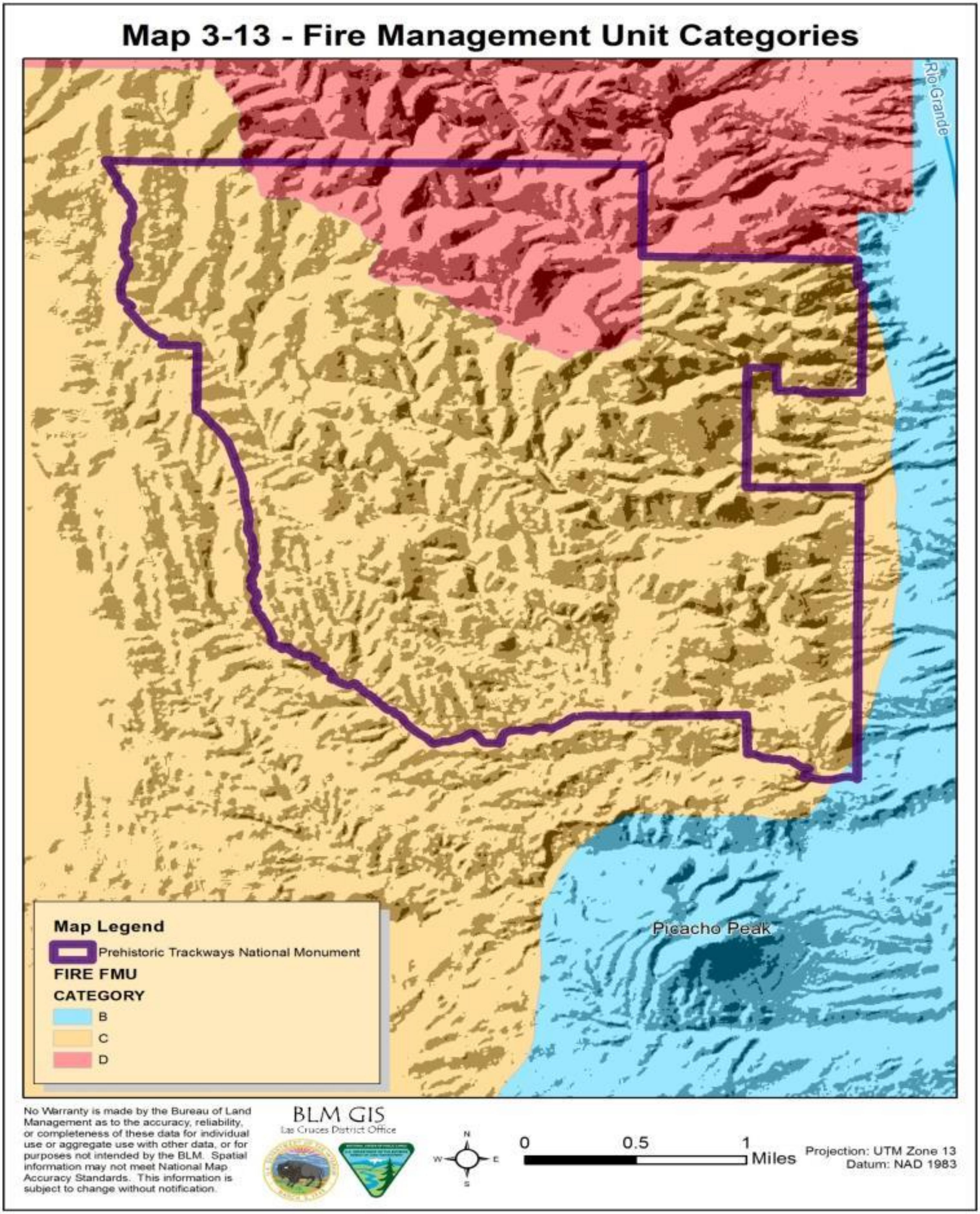


Table 3-16 Fire Regime Condition Classes

TABLE 3-16 FIRE REGIME CONDITION CLASSES		
CONDITION CLASS	**ATTRIBUTES**	**EXAMPLE MANAGEMENT OPTIONS**
Condition Class 1	Fire regimes are within or near a historical range. The risk of losing ecosystem components is low. Fire frequencies have departed from historical frequencies by no more than one return interval. Vegetation attributes (species composition and structure) are intact and functioning within a historical range.	Where appropriate, these areas can be maintained within the historical fire regime by treatments such as prescribed fire and allowing lightning fires to burn.
Condition Class 2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components has increased to moderate. Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. Results are moderate changes to one or more of the following: fire size, frequency, and intensity, severity, or landscape patterns. Vegetation attributes have been moderately altered from their historical range.	Where appropriate, these areas may need moderate levels of restoration treatments, such as prescribed fire and hand or mechanical treatments.
Condition Class 3	Fire regimes have been significantly altered from their historical range. The risk of losing ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals and results in dramatic changes to one or more of the following: fire size, frequency, intensity, or severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range.	Where appropriate, these areas may need high levels of restoration treatments, such as hand or mechanical treatments. These treatments may be necessary before prescriptive fire treatments are used to restore the historical fire regime.
SOURCE: Bureau of Land Management, 2004a.		

These wildfire management strategies take into account: safety, cost, and resource objectives, in that order of prioritization. FMUs are created based on geographic, social, and political characteristics. The FMUs are assigned a fire management category(s) that dictate a management approach for each unit. Public land is assigned to one of the following fire management categories (See Map 3-13):

- Category A: Areas where fire is not desired at all.
- Category B: Areas where unplanned wildfire is not desired because of current conditions.
- Category C: Areas where fire is desired, but there are significant constraints on its use.
- Category D: Areas where wildland fire is desired, and there are few or no constraints on its use.


Map 3-13 - Fire Management Unit Categories
Rio Grande
Picacho Peak
Map Legend
Prehistoric Trackways National Monument
FIRE FMU
CATEGORY
B
C
D
No Warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by the BLM. Spatial information may not meet National Map Accuracy Standards. This information is subject to change without notification.
BLM GIS
Las Cruces District Office
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Projection: UTM Zone 13
Datum: NAD 1983

Three FMUs are found within the Monument (see Table 3-17). The FMU categories are shown on Map 3-13. These categories allow management to prioritize resources if there are multiple wildfires occurring at the same time.

Table 3-17 Fire Management Units within the PTNM

TABLE 3-17 FIRE MANAGEMENT UNITS WITHIN THE PTNM		
FIRE MANAGEMENT UNIT	**ACRES**	**FIRE MANAGEMENT CATEGORY**
Rio Grande Valley Uplands	4,469	C
Robledo Mountains WSA/ACEC	782	D
Rio Grande Corridor	4	B

Where necessary, emergency stabilization treatments would be implemented and completed within one calendar year from the date of the control of wildland fire. Rehabilitation of non-emergency actions due to wildland fires must be completed within 3 years of the date of the control of fire with funding for rehabilitation prioritized using common criteria (BLM 2005). Wildland and prescribed fires are monitored according to variables described in the *Resource Management Plan Amendment for Fire and Fuels Management on Public Lands in New Mexico and Texas* (BLM 2004a). Fuel treatment and fire suppression activities would be consistent with the *New Mexico Standards and Guidelines for Livestock Grazing Management* (2001).

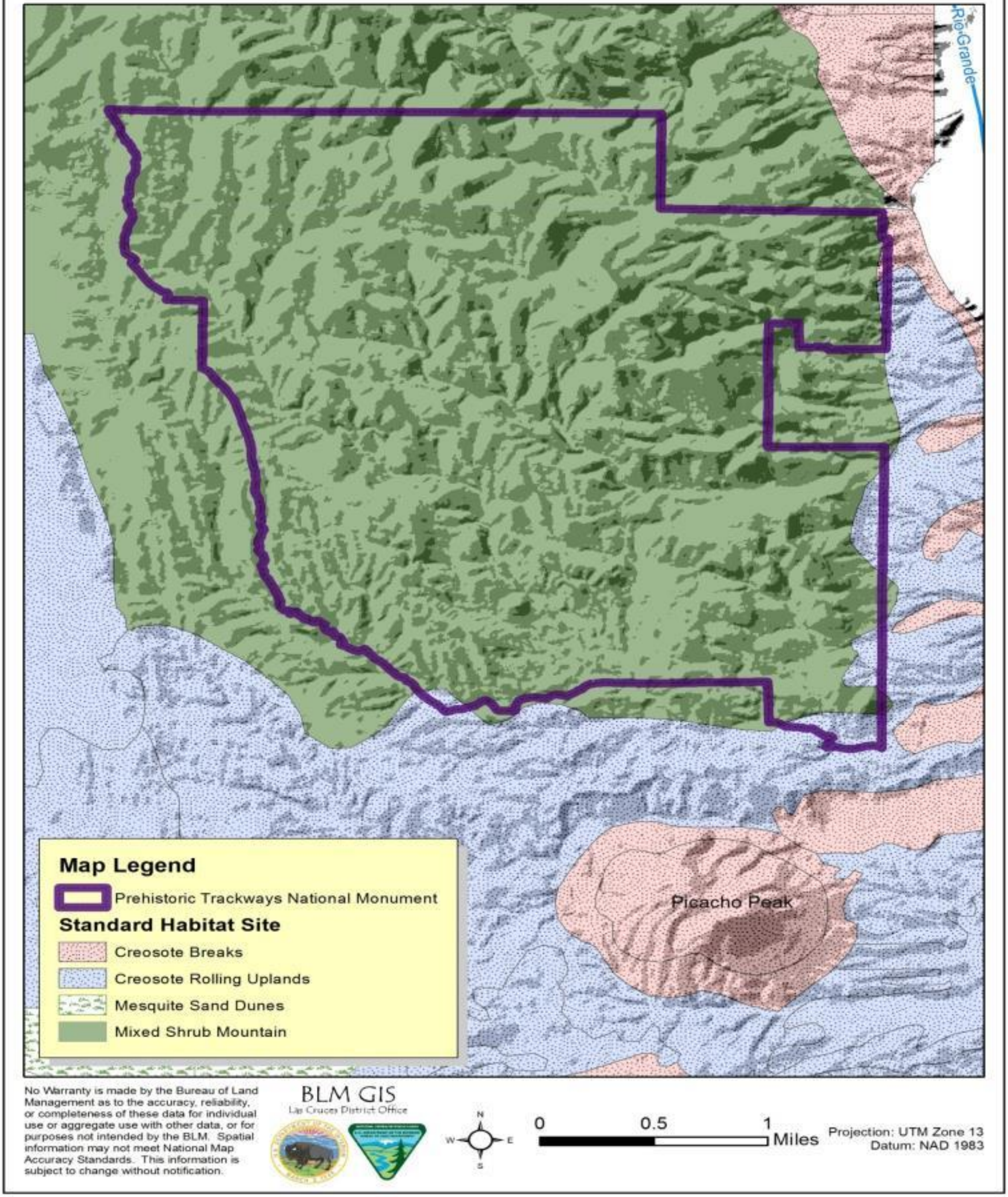
3.2.20 Wildlife

In terms of habitat quality for wildlife, the PTNM has steep slopes dominated by rocky soils, with sparse vegetative cover dominated by creosote. Arroyos dissecting the hillsides have sandy bottoms and support a slightly more diverse overstory, such as Apache plume and little-leaf sumac. Compared to other habitats in the Chihuahuan Desert, the site has low productivity and diversity. The BLM has classified wildlife habitat referred to as Standard Habitat Sites (SHSs). SHSs are the primary indicators for wildlife and habitat to assess habitat quality. This also allows for identification of and monitoring of specific issues at the landscape level in the *Planning Area*. The BLM-based SHSs are used as indicators because they provide the best available data on current condition, trends, and forecasts of wildlife and habitat. The SHSs were designed at a large scale and do not break the habitats down by vegetative communities that may occur on different soil types. To gain an understanding of which habitat types occur in an SHS, the ecological site descriptions discussed in the Vegetation section of this document are utilized (limestone hills, hills, draws, gravelly, and gravelly sand). The *Planning Area* is comprised primarily of the Mixed Shrub Mountain SHS with a small area of Creosote Breaks SHS along the eastern edge (See Map 3-14).

3.2.20.1 Mixed Shrub Mountain

Shrub species dominate the vegetation composition of this SHS along with an understory of grama grasses (*Bouteloua* spp.), bush muhly *(Muhlenbergia poteri)*, slim tridens (*Tridens muticus*), and three-awn (*Aristida* spp.). Characteristic shrubs are broom snakeweed *(Gutierrezia sarothrae)*, whitethorn acacia *(Acacia constricta)*, catclaw mimosa (*Mimosa aculeaticarpa*), Apacheplume *(Fallugia paradoxa)*, skunkbush sumac *(Rhus trilobata)*, and mountain mahogany *(Cercocarpus montanus)*. This SHS is located between surrounding uplands and below the piñon-juniper vegetative community. Species diversity is high for mammals, moderate for herptiles, and low for birds (BLM 1983).

Map 3-14 - Standard Habitat Sites



Typical wildlife species of the mixed shrub mountain habitat type include tree lizards, Chihuahuan whiptails, Great Plains skinks, rock rattlesnakes, canyon wrens, white-throated swifts, rock squirrels, javelina, and mule deer.

On the Monument, the mixed shrub mountain SHS is primarily made up of the limestone hills and hills ecological sites with several drainages throughout (See Map 3-9). Over time, the vegetative composition of the Monument has become shrub dominated (See Section: 3.2.16-Vegetation). Overall, the wildlife habitat on the Monument more closely resembles the Creosote Breaks SHS and does not have great species diversity.

3.2.20.3 Creosote Breaks

Vegetation in this SHS is dominated by creosotebush (*Larrea tridentata*) found on steep slopes and gravel ridges. This SHS experiences a high degree of soil erosion. Ecological condition and species diversity has not been identified for this SHS.

Typical wildlife species of creosote breaks include Couch's spadefoots, western whiptails, side-blotched lizards, western diamondback rattlesnakes, cactus wrens, Merriam's kangaroo rats, and black-tailed jackrabbits. Because of proximity to the Rio Grande, this is an important wildlife habitat.